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JAPAN REPORT

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ECONOMIC

OUTLINE OF MITI FY84 POLICY REPORTED

Tokyo JIHYO in Japanese Oct 83 pp 66-72

[Text] New Policies, New Projects Being Juggled About

The Ministry of International Trade and Industry (MITI) recently put together its 1984 budget request and its trade and industry policy, and then entered into negotiations with the Ministry of Finance. According to these documents, the amount of the budget request in the general account is 826.71 billion yen, a mere increase of 0.8 percent over the year before. However, in the Fiscal Investments and Loans Plan, there are figures of 5,965 billion yen, a 9.4 percent increase, as the size of the fiscal investments and loans, and 10,227 billion yen, a 9.7 percent increase, on an enterprise basis. Each of these figures ensures close to double digit growth, and, in light of the difficult fiscal situation, has the strong characteristic of policy inducement with financing. New policies and new projects are being juggled within these figures, including preparation of computer-related laws, construction of the new media community, advancement of the comprehensive import promotion policy, a special financing system to attract corporations with foreign capital, and the aqua-rennaissance. What is evident is that MITI is diligently switching its policy from being a model of a world economic follower to a model of a world economic leader moving toward the realization of a high information-oriented society.

Pointing Out the Risks of Declining Industrial Activity Caused by Sluggish Domestic Demand

MITI, in putting together its budget for the new fiscal year and its new policy, acknowledges, as its basic premise, that "Japanese economic society is attempting to accommodate itself to one of the great historical turning points" (Administrative Vice Minister Kazuo Sugiyama). This is because, in the midst of greater diversity and a higher order of national needs and the continual progress of knowledge intensification in the industrial area, signs of change are appearing in industrial society (the high information-oriented society), which demonstrate the creation of a new culture that takes advantage of the rapid technological revolution in such fields as information and electronics technology, bioengineering, and materials engineering. The development of the high information-oriented society is not merely a revolution within industry, but it exerts direct and indirect effects on every aspect of economic society. Mr Sugiyama has also said that "we are entering an era where we will have to penetrate an unexplored society by means of our own intelligence and creativity."

On the one hand, in our international economic relations, our country will bear one segment of world economic leadership, alongside Europe and the United States. As International Trade Policy Bureau Director General Ekio Shibata puts it, "We have reached an era where we must switch from the past model of a world economic follower to that of a world economic leader." Therefore, MITI sees that the basic task of the world economy, in reaction to the protectionist pressures in Europe and America and the debt accumulation problem in the developing countries, is to make more secure the economic recovery that is appearing in some quarters and to link this to continual progress. However, MITI has been pointing out that our country's economy runs the risk of having a decline in industrial activity, for both the mid-term and long-term, because in the midst of domestic demand, in which the decline of capital investment and the sluggishness of housing investment and personal consumption continue, and the surpluses in the balance of current accounts and balance of trade expand due to falling imports.

To Make a Positive Contribution to the World Economy and to Establish a Base for the Development of Japan

Consequently, MITI, along with working for the formation of harmonious external economic relations and the achievement of economic growth based on the demand leadership model, has been steadily showing its determination, on its own, to lead in a high information-oriented society, and has raised as the Trade and Industry Policy theme for 1984, "To make a positive contribution to the world economy and to establish bases for the development of Japan." Specifically, emphasis is being placed on five topics: (1) formation of bases for creative development; (2) a contribution to the continual development of the worldwide economy and the formation of harmonious external economic relations; (3) steady promotion of a resource and energy policy from a long-term perspective; (4) development of a small and medium firm policy that responds to the new era; and (5) formation of an appealing regional economic society and fulfillment of a base for a high quality and diverse national lifestyle. On the basis of these, MITI is moving ahead with an extremely detailed and concrete expansion of its policy.

(1) Formation of Bases for Creative Development

The primary pillar that MITI is upholding in the exposition of its policy for 1984 is the formation of new bases for the development of Japanese economic society. In recent years signs of change in industrial society have appeared in our country by the advance of the new technological revolution, such as the rapid forming of the high information-oriented society. MITI's Machinery and Information Industries Bureau Director General Manabu Shiga has said, "It is vital to prepare an environment conducive to the development of these bases as a motivating force for the next generation, to work toward the creative development and use of high technology, and to strengthen the bases to preserve the future anticipated increase in results of technological developments."

Officials in MITI feel that the formation of these bases for development will be a good omen in that they will prevent in advance, by the promotion of capital investment, the mid-term and long-term decline of industrial activity. Moreover,

there are those who feel that the formation of these bases are well understood to be a contribution to the world by opening a new frontier for the world.

Consequently, as a matter of concrete policy, MITI has made "the preparation of the bases for the high information-oriented society" its prime objective.

This includes positively advancing such high-tech developments as fifth generation computer research and development, as had been done in the previous fiscal year, and working toward promotion of the efficient development and smooth distribution and use of software, as well as studying the legal means for protecting such software. In addition, comprehensively promoting this policy will include the study of legal steps to achieve guarantees for the reliability of computer systems and the protection of data from those systems.

These are being worked out as part of the new policy by various allotments of the budget request in the general account for the promotion of new media (totaling 115 million yen), such as the Model Community Information Systems Development Program (78 million yen); the Promotion of Data Bases and Information Supply (36 million yen); and the Investigation of Information-related Activities (26 million yen). In addition, the regular session of the Diet is being presented with the Program Registration Act (proposed name), which aims to promote the development and distribution of computer software, and the Computer Security Act, which takes as its objective the guarantee of the reliability of computer systems and the protection of their data.

Of these, the Model Community Information Systems Development Program is a 5-year program that will take place between 1983 and 1988 in 8 to 10 model regions. It will carry out the design, development, testing, operation, and evaluation of the high information-oriented systems that back up the new media, such as INS (Nippon Telegraph and Telephone's Information Network System) and CATV (cable television). MITI will invest practical experimental costs per region of 2 billion to 3 billion yen. Already, the Ministry of Posts and Telecommunications has worked out a similar regional development concept called "Teletopia" as its new policy for 1984. The word is out that MITI and the Ministry of Posts and Telecommunications will struggle for jurisdiction in this area and that the 1984 budget will serve as a fierce battleground.

This struggle is being taken up in the new policy of New Media Promotion. MITI is waving about, as its new media policy, the systematic standardization of new media equipment, a drastic review of electronics communications-related systems, and the preparation for the base of the CATV network by private rail lines and electric power.

In contrast to this, the Ministry of Posts and Telecommunications has decided that, in order to support CATV and VAN (value-added network services) by financial measures, it will carry out, from 1984 on, special interest loans from the Japan Development Bank (the loans will have a term of 7 years, an interest rate of 3 percent, a loan ratio of 50 percent, and a total scale of 3 billion yen). Thus, the ministry has decided to launch its first industrial financing measure.

The conflict between the two ministries over the construction of the high information-oriented society is giving the appearance of emerging all of a sudden in the 1984 budget and of becoming a political problem.

In addition to this, the following are being raised as concrete policy for the formation of creative bases for development; the enhancement of a base for applications of high technology; the advancement of the creative development of technology; the enhancement of industrial property administration; the advancement of industrial activity; the advancement of public enterprises that use private funds; and the study of the changes to and responses by economic society surrounding industrial adjustment. In order to promote venture businesses as the vehicles for breaking the ground in these new fields, MITI is working on new policies, such as advancing a comprehensive policy regarding the facilitating of funds procurement and the promotion of research and development (200 million yen); furthering development of a resource exploration satellite system as a large-scale project of the Agency of Industrial Science and Technology (45 million yen); and establishing a "Regional Technology Exchange Center" for exchanges among business, government, and academia in the Regional Block Research Institutes of the Agency of Industrial Science and Technology.

Moreover, as far as new policies for faltering industries are concerned, MITI has decided to revise and extend the current temporary laws for the adjustment and improvement of the textile industry in order to respond to the small volume and short cycle of various goods and to move further toward internationalization in the adjustment of demand, as well as to advance the conversion of Japan's textile industry toward an "advanced country-type industry."

(2) A Contribution to the Continual Development of the Worldwide Economy and the Formation of Harmonious External Economic Relations

MITI recognizes that Japan's economy is $10 percent of world's economy," and beieves that it is necessary to make both a positive contribution to the world economy in full recognition of this position and role, and to aim for the formation of harmonious external economic relations. Consequently, MITI believes that it is vital to recognize fully the benefits of free trade for the continued development of the world economy, and, in the first place, by taking into account present economic conditions, to assume, as a task of the exposition of this policy, greater efforts to increase imports.

Furthermore, in order to make a constructive international contribution, MITI is advancing research and development cooperation and industrial cooperation with the advanced countries by increasing past efforts, as well as taking into consideration Japan's close relations with the developing countries and advancing more positive and comprehensive economic cooperation.

Consequently, import promotion measures are being taken up as a focal point of the overall 1984 trade policy. While support of the free trade system and a balanced expansion of trade are regarded as fundamental, MITI is positively developing its import promotion measures by making adjustments to import financing and the tariff system and by making better use of the Japan External Trade

Organization (JETRO). In addition, MITI is furthering measures to liberalize its standards and certification system for overseas goods (at a cost of 10 million yen).

One-hundred eight million yen will be appropriated next year for the overall import promotion enterprise, which is double the 55 million yen appropriated for 1983. As part of this, MITI will make special low interest loans available to importers of electric equipment and automobiles when these firms make capital investments to improve their sales promotion structures, especially for the "maintenance care" of the product sold. This action is being taken to eliminate the gap in competitive strength between domestic goods and imported goods that results from the less rapid service and parts supply system of the overseas manufacturer. The aim is to work for the promotion of imports of products that take advantage of this opportunity. MITI expects that the interest rate will be 7.3 percent, the loan ratio will be 70 percent, and the total size of the loans will be 7 billion yen.

Moreover, significantly to advance international research and development cooperation and industrial cooperation, Japan is positively advancing international cooperative projects involving solar power cells and advanced robotics, as agreed upon at the recent summit of the heads of the advanced nations, and is working toward furthering the employment and acceptance of foreign researchers. In addition, MITI is continuing to move ahead with international joint development of the private transport plane "YXX" and jet engine for use in private planes, as well as moving ahead with international research and development cooperation involving the fifth generation computer. In connection with this, MITI has decided to introduce new preferential measures for firms with foreign capital from the Japan Development Bank, in order to further the attraction of these foreign-capitalized firms to Japan. This will consist of the establishment of a "Japan Investment and International Exchange Promotion Financial System" in the Japan Development Bank, and the provision of special financing, at an interest rate of 7.8 percent and loan ratio of 40 percent, for foreign capital investment projects in Japan, and a large-scale international exhibition program. There has already been financing through providing regular interest to foreign investors, but this will be the first time that financing by special interest rates is being attempted. MITI has decided to appropriate 3 billion yen for the 1st year, and to further future foreign capital investment in Japan as well as to keep international exchange active.

Other than this, MITI is playing up, as important policy themes, furthering overall economic cooperation, reacting to the debt accumulation problem, and increasing mutual international understanding.

(3) Steady Promotion of a Resource and Energy Policy From a Long-Term Perspective

The resource and energy policy for 1984 was drafted by taking into account "The Long-Term Energy Supply and Demand Forecast (Tentative Estimate)" and "Overall Inspection of Energy Policy," that the Comprehensive Energy Research Section (headed by Hiroshi Arisawa) put together, a section that is an advisory body to the MITI minister. What is noteworthy about this supply and demand forecast is

that it looks at the international energy situation, which has lately seen both supply and demand easing, and both revises downward the overall energy demand for 1990 to about 450 million to 480 million kiloliters as calculated on a petroleum basis, a downward revision of about 22 percent in contrast to the last supply and demand forecast made in April of 1982, and revises upward from the last supply and demand forecast the degree of dependence on oil from 49.1 percent to 52 percent.

However, Tadashi Toyoshima, the director of the Agency of National Resources and Energy, has said, "Changes have occurred in the energy situation, such as the easing of the international supply and demand for oil caused by the development and introduction of alternate energy sources for the oil-consuming countries, and the decline in the prices of OPEC oil, but, in the long-term, international supply and demand for oil will tighten, and there will still be many fluid factors in the international oil situation, such as the unstable Middle East situation." Therefore, while keeping in mind the demands for a reduction in energy costs, MITI is steadily placing resources, especially the guarantee of their security, at the center of a resource and energy policy to overcome energy constraints.

Consequently, MITI is hoisting as its primary energy policy a secure supply base for oil. Along with that, MITI is furthering the adjustment and improvement of its petroleum industry, which has at its center the introduction of a petroleum industry capital loan interest and subsidy system by means of the special account for coal, oil, and alternate energy countermeasures (1.25 billion yen). MITI is also making strong efforts to move ahead with the advancement of the petroleum reserve, the advancement of petroleum development, and the ensurance of stable LPG supplies.

Taking into account this new long-term supply and demand forecast for energy, MITI, along with aiming for the progressive internationalization of the principle of refraining products at the locale of the consumer, is,at the same time, moving ahead with a shift of policy by working for the promotion of placing on land oil that is stored, at high cost, in tankers.

As far as moving ahead with the development of alternate energy and energy conservation is concerned, although MITI has decided to follow through with its basic policy up to now, it is now aiming for efficient operations. In particular, with regard to the coal liquefaction projects, along with unifying past methods in the NEDO (New Energy Development Organization) method, MITI is attaching a priority order to new energy development.

In addition, MITI has decided to move ahead with a greater effort in the following: the advancement of energy conservation and energy conversion; the advancement of alternate energy technology development; electric power diversification; electric power location; nuclear fuel cycle commercialization; and the ensurance of stable coal supplies.

Furthermore, in order to ensure stable resource supplies, MITI is continuing to move ahead in 1983 with the storage of rare metals, the development of domestic and foreign mines, and the development of deep seabed mineral resources.

However, there are many fluid factors in the financing of alternate energy, such as the decline in the price of crude oil, and the outlook for this issue is still difficult to predict. MITI foresees that a final decision on this, including the introduction of a new tax, will be deferred until the very last moment.

(4) Development of a Small and Medium Firm Policy that Responds to the New Era

MITI believes that the small and medium firms are important vehicles in the life of Japanese economic society, and expects that their role as a wing of the creative development of the Japanese economy will expand.

Small and medium firms should be able to play this role fully in the future, and Japan must work towards the development of a small and medium firm policy that responds to this new era. Tadayoshi Nakazawa, the head of the Small and Medium Enterprise Agency, consequently states, as the basic rule of small and medium enterprise policy for 1984, "the improvement of an environment in which the creativity and the mobility of small and medium enterprises are fully displayed," and has decided to move forward with a concrete exposition of this policy.

Therefore, in addition to the promotion of the venture businesses that were touched upon previously, MITI has decided to move ahead with the promotion of organizational measures and the advancement of modernized and high quality enterprises.

With regard to the enhancement of organizational measures, MITI is working out new policies such as the introduction of an alliance system for different types of firms, taking as its object 35 different associations, and the introduction of a business strategy system, taking as its object 5 different associations.

As the second pillar of small and medium enterprise policy, MITI has decided to enhance the business base of small and medium firms, and to work for the expansion of the size of the loans provided by the three government organizations that finance small and medium firms.

Specifically, MITI is ensuring the amount of ordinary loans provided by the Small and Medium Firm Finance Corporation at 2,305.5 billion yen (2,175 billion yen in 1983) and by the People's Finance Corporation at 2,953 billion yen (2,817 billion yen in 1983), and is aiming for a pure increase in the amount of the loans provided by the Central Cooperative Bank for Commerce and Industry of 600 billion yen (550 billion yen for 1983).

Furthermore, by moving ahead with such enhancements as measures for small and medium subcontracting firms, measures for government and public demand, and measures to prevent bankruptcies, and by increasing the development of new technologies for small and medium firms, MITI aims to strengthen the business base of such firms.

For example, MITI is proposing the creation of "A Tax for the Systematic Advancement of New Technologies for Small and Medium Firms" in order to work

toward an increase in the productivity and the modernization of the management of small and medium firms, by means of furthering the introduction of mechatronics machines which have made remarkable technological advances, and of information machines, such as computers.

In addition, MITI is advocating a trade in services policy for small and medium firms, the fostering of small and medium firms that complement their regions and the enhancement of the small-scale firm policy. With regard to capital loans to improve businesses, such as small businesses that are connected with the small-scale firm policy, MITI worked to improve lending conditions by increasing the amount of the loans to a total of 19,236,000,000 yen (18,839,000,000 yen for 1983), and, on top of that, by raising the lending limit for plant and equipment capital to 4 million yen (the present limit is 3.5 million yen).

As a result, although the 1984 budget for small and medium firms, at 167.5 billion yen, is a reduction of 4.8 percent from the original budget for 1983 (176 billion yen), the Small and Medium Enterprise Agency is saying that "even though this can be called a 'minus' budget, its contents are enhanced."

(5) Formation of an Appealing Region Economic Society and Fulfillment of a Base for a High Quality and Diverse National Lifestyle

Industrial Location and Environmental Protection Bureau Director-General Kengo Ishii has said that, for creative development by Japan that is oriented toward the society of the 21st century, "aiming for the development of a well-balanced economy across the entire nation is extremely important from the perspective of the effective use of Japan's limited national resources, and the formation of an appealing regional economic society is necessary, such as the promotion of regional economies that focus on the technopolis concept and concentrate on technology." Therefore, the industrial location policy for 1984 is taking on an outlook that is unfolding into a positive attitude that it did not have up to now, an outlook focusing on the technopolis concept.

The technopolis concept, which is the attempt to form appealing regional municipalities that have high-tech industries at their center and are the joint work of business, government, and academia, is already being implemented by technopolis-related laws (The High-Technology Industrial Concentration Regional Development and Promotion Act), and is just awaiting regional ordinances (implementation of the program).

In that sense, 1984 is the year in which the first step toward the concrete realization of the technopolis concept took place, and MITI aims to expand and strengthen related policies.

Consequently, along with dealing positively with regional promotion policies for the formation of technopolises by tax measures and by financial measures connected with leasing, MITI is expanding measures for increasing the technological capacities of regional centers and small and medium firms, and is aiming toward the comprehensive promotion of technology in the various regions.

In connection with this, MITI is dealing with the aquarennaissance (the development of technology to be applied to the regeneration of water; 40 million yen was appropriated for the first year), which is a response to the shortage of water for industrial use that may occur in the future during the course of the realization and development of modern industrial municipalities in every corner of the country. The aquarennaissance can be said to be a means of opening the way for the reuse of polluted water by employing biotechnology. MITI is aiming for systematic application of this technology by 1990.

In addition, with regard to "the fulfillment of a base for a high quality national lifestyle." MITI is working out new policies, such as moving ahead with the development of new materials and machine systems technologies for collective housing that is superior in durability and habitability (30 million yen).

As can be seen from the above, the 1984 MITI Trade and Industry Policy incorporates measures that are as positive as they can be under the severe "minus ceiling" fiscal situation. Serious efforts are continuing within MITI on the road toward the continued development and greater activity of the Japanese economy. We want to watch closely for the results of these efforts that come from the free use of the intelligence and creativity of MITI officials.

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CITY BANKS TO BE MORE CAUTIOUS WITH FOREIGN LOANS

Tokyo KINYU TO GINKO in Japanese 12 Aug 83 pp 96-97

/Text/ International Division Is a Pillar, Even Profit-wise

International operations have become an indispensable support for Japanese banks. Of the total assets, the ratio occupied by foreign currency assets has exceeded 30 percent and the foreign currency balances of the top-ranking city banks are estimated to be from $33 to $36 billion, respectively.

As for profits, of the 13 city banks' total crude operating profits of 2,907,200,000,000 yen (previous fiscal year--2,403,100,000,000 yen), international operations accounted for 530.1 billion yen (previous fiscal year--383.7 billion yen). The share increased from 15.9 percent of the previous fiscal year to 18.2 percent, a rise of over 2 percent. Especially, in recent years, the increase in volume and profits of international operations has been noticeable.

In the history of Japanese banks' international operations, which had developed smoothly till now, FY-1982 marked a year of change in account settlement. That is, with regard to country risk, a special foreign loan reserve system was newly introduced. For the reason that loan recovery was impossible or there was future risk, reserve funds have to be set aside for over 20 countries, including such Central and South American countries as Brazil, Argentina and Mexico, Southeast Asian countries such as Vietnam and East European communist-bloc countries such as Poland, etc. The 13 city banks established reserve funds for a total of 25 countries.

The total reserve fund of all the city banks amounts to 170 billion yen and the total loans to foreign countries reach the huge sum of 4.4 trillion yen. Another point to note is that the reserve ratio of reserve fund differed with the banks. This is because the guidance of the Ministry of Finance stipulated that the rate should be within one to five percent of the total loan to that country. As a result, banks which set aside reserve at the upper limit of 5 percent were Fuji, Sumitomo, Sanwa and Mitsui, followed by Mitsubishi at 4.5 percent and Hokkaido Takushoku at 1.6 percent.

It is risky to judge the posture toward foreign loans, basic fiscal strength, etc., of the different banks on the basis of the order of reserve ratio. However, variations in trends and policies can be gleaned and the figures indicate that differences in scale of international operations are definitely widening.

Sumitomo Bank had the biggest reserve fund of 26.9 billion yen. Understandably, Sumitomo was also the top in earnings (crude earnings) gained by the international division. The longstanding view of President Isoda of this bank is: "In order successfully to weather the present international monetary uncertainty, loans to cumulative debtor countries must not be stopped but through the cooperative efforts of the government and people of the respective countries, certain amounts of loans should be continued. For that reason, it is important to reduce the burden on the private sector and the present foreign loan reserve system is unsatisfactory. First of all, the reserve fund should be made nontaxable and if possible, 5 percent should be set aside annually and the minimum ratio raised to 20 percent. Only then will international cooperation be possible while maintaining the sound footing of banks." This posture is reflected in the sale of securities by the Sumitomo to put up the maximum reserve.

Omitting The Bank of Tokyo, which specializes in foreign exchange, the Fuji Bank leads in foreign loans with 2.55 trillion yen. On the other hand, its reserve fund is 18.8 billion yen or 8 billion yen less than the Sumitomo Bank. The reason is believed to be that Fuji's loans to advanced countries, such as European nations and the United States, were relatively heavy.

Now Is the Time To Build Up Strength

In the FY-1982 settlement, there are indications that various countries are gradually beginning to change their stance toward international loans. Deducting domestic accounts from the term-end total deposits and loans, figures show that overseas deposits amounted to 42 trillion yen at the end of FY-1982, an annual increase of 5.3 trillion yen. Overseas loans amounted to 16 trillion yen, an annual increase of 1.7 trillion yen, which reveals a slowdown in the increase. This was influenced by the term-end high yen rate, which resulted in conversion lossses, but more than that it was effected by the deferment of various banks to use Eurodollars in their operations and suppression of foreign loans.

With mounting uncertainty in international finances, banks changed their strategy from aiming at increased volume to securing steady profits.

International operations of Japanese banks became active in the late 1960's but it was not until the 1970's that they assumed full-scale proportions. Until about 1974, city banks greatly expanded their operational bases by establishing local corporations, branches and amalgamated banks for investment pruposes. Foreign loans began to increase from about 1975 and ballooned from about 1979-80. Taking the top-ranking city banks as an example, foreign loan balance was less than 2 billion dollars in FY-1977 but it increased to the 4 billion dollar level in FY-1979 and to the 8 billion dollar level in 1981. This level of increase is true of not only one bank. This was the period of so-called "expansive banking." Consequently, the recent balance has exceeded $10 billion.

The demand for capital by Japanese manufacturers operating overseas accounted for part of the foreign loans but the majority of the increase consisted of sovereign loans. Middle- and lower-ranking city banks were not exceptions and to compete against the big banks, scurried around to become "managers" of syndicate loans.

It is only natural that Japanese banks appeared at the top of the syndicate loan annual performance rankings given inthe international monetary magazines, EUROMONEY and ASIAN FINANCE. In the case of Japanese banks, a considerable amount of money was funneled to overseas project financing of large Japanese enterprises intent on securing natural resources.

However, at present, the main trend is to reassess the extended fronts and to nurture strength for the next leap. Hitherto, officials in charge of international finances had been "bold and prudnet" but first priority was on taking bold actions. However, it is said that recently, the motto is to be "both prudent and cautious."

As for future international finances, the main participants are in agreement in sizing up the situation as, "Because of intensifying competition directed at advanced countries, the profit margin will become smaller and it will be important shrewdly to grasp the opportunity for high risk and high return." To meet the challenge of high risks, one must have the strength to cope with the situation. In that sense, the change to "both prudent and cautious" does not mean at all that one has become cowardly or passive.

In contrast to the past main practice of taking in short-term Eurodollars and switching them to long-term loans, issuance of long-term overseas bonds and other diverse capital procurement methods have been developed recently. Also, overseas securities operations have been trengthened and there are cases where institutional investors, in European and American stock exchanges were won over through securities dealings. Yen loan is one of the big weapons.

With strength restored, the present temporary rest period is sure to be rewarded.

Table 1. Differences in Foreign Loan Reserve and International Profits

(Units: 100 million yen; %)

海外債権引当金，国際収益にも格差

（単位：億円，%）

		(1) 国際部門貸出残高（対総貸出比）	(2) うち引当対象債権（比率）	(3) 引当金	(4) 引当率	(5) 対象国数	(6) 国際業務収益
(7)	第一勧銀	22,100(16.8)	4,994(22.6)	175	3.5	14	426 (385)
(8)	富　士	25,500(22.0)	3,783(14.8)	188	5.0	17	620 (436)
(9)	住　友	23,711(20.9)	5,398(22.8)	269	5.0	16	651 (497)
(10)	三　菱	21,586(19.3)	4,213(19.5)	190	4.5	19	426 (350)
(11)	三　和	20,317(18.5)	4,542(22.4)	227	5.0	18	532 (392)
(12)	三　井	18,843(23.1)	2,872(15.2)	143	5.0	14	354 (279)
(13)	東　海	13,317(17.1)	3,580(26.9)	143	4.0	21	335 (255)
(14)	太陽神戸	9,568(12.9)	2,260(23.6)	56	2.5	18	231 (196)
(15)	大　和	5,762(12.3)	1,221(21.2)	26	2.1	14	139 (117)
(16)	協　和	5,169(10.3)	1,193(23.1)	20	1.703	16	152 (107)
(17)	埼　玉	4,568(11.5)	1,250(27.4)	28	2.3	16	96 (74)
(18)	拓　銀	5,696(16.6)	1,375(24.1)	21	1.6	13	114 (75)
(19)	東　京	36,000(55.6)	7,126(21.7)	214	3.005	23	1,124(1,067)
(20)	合　計	212,137(20.3)	43,807(21.0)	1,700	3.89	全対象25	5,301(3,837)

(21)

注 1) 一部推定含む。

(22) 2) 国際業務収益のカッコ内は56年度数値・億円。

Key:

1. International division loan balance (ratio to total loan)
2. Loan requiring reserve (percentage)
3. Reserve fund
4. Reserve rate
5. Number of countries
6. International operations profits
7. Dai-Ichi Kangyo Bank
8. Fuji Bank
9. Sumitomo Bank
10. Mitsubishi Bank
11. Sanwa Bank
12. Mitsui Bank
13. Tokai Bank
14. Taiyo Kobe Bank
15. Daiwa Bank
16. Kyowa Bank
17. Saitama Bank
18. Hokkaido Takushoku Bank
19. Bank of Tokyo
20. Total
21. Total countries established reserve
22. 1) Includes estimates.
    2) Parenthetical figures in "international operations profits" column are for FY-1981/in 100 million yen

CHANGE IN HITACHI, TOSHIBA, MITSUBISHI GROUP NOTED

Tokyo SHUKAN DAIYAMONDO in Japanese 13-20 Aug 83 pp 102-105

[Text] Promotion to Consolidated Subsidiaries

[Performance of production companies has sharply dipped. Sales companies are holding firm overseas. Service companies are contributing greatly. In the future, we have no other choice but to increase service companies to expand our consolidation." (Managing Director Hiroo Namaezawa, Mitsubishi Electric)

Something unusual is happening to the consolidated accounting of three general electric companies. For example, let us look at Hitachi, Ltd, which achieved a 7-year steady increase in income and profit on the basis of consolidated accounting in the term ending in March 1983. You will readily notice a phenomenon when you study the details. The "tripod,"--Hitachi Metals, Hitachi Chemical and Hitachi Cable--is not doing well, while Hitachi Maxell, Hitachi Plant Engineering and Construction, Nissei Sangyo and Hitachi Credit show fantastic growth. This trend has been noted for the past several years. What is particularly outstanding this time is the heading of a software and service companies along with these regularly well-run companies. All of them show a 20-30 percent growth.

Toshiba Corporation, which came up with reduced profit on the basis of consolidated accounting due to a slump in the heavy electric machinery sector, the main body of its corporate operation, faced aggravation of business, showing mainly in the Central and South American overseas sales companies. Although that was a setback, successful electronics-related Tokyo Electric and software-related Toshiba Engineering showed a bright outlook in the gloom mood of falling profits.

Mitsubishi Electric, just like Hitachi, has achieved 7 consecutive years of income and profit increases on a consolidated base. As mentioned in Managing Director Namaezawa's' remarks, introduced at the head of this article, production companies did not do well, as seen in Tada Electric, a cooler maker for heavy electric machinery, which tumbled into fiscal deficiency. In contrast, overseas sales companies in Indonesia and Holland excelled, and Ryoden Service, Ryoden Engineering, Mitsubishi Electric Service Center and community-based Electric Plant Service (four locations) achieved increased profits and contributed to a consolidated income and profit increase.

With these favorable business showings of software and service companies, Mitsubishi Electric recently promoted Ryoden Engineering and Mitsubishi Space Software to a consolidated subsidiary. It is concluded that the importance of the status of the software and service companies has risen to that extent.

Well-planned Outposts Complement Growth

Why are these software and service companies doing well? In Hitachi, 17 software-related companies organized the Hitachi Software-related Affiliates Council. Members and their share of duties are illustrated in the graph. The oldest is Hitachi Engineering, which was established in 1957 and is in charge of plant engineering. Next in line is Nippon Business Consultant, which was established in 1959 and is in charge of software development, sales and data processing. Hitachi Electronics Service was established in 1962 for maintenance of computers and communication machines, and Hitachi Software Engineering was established in 1970 for computer software development and design.

The remaining 13 companies are young companies which sprouted since September 1978.

Of the 17 establishments, the top in 1982 income return was Hitachi Electronics Service. Among the software-related companies in the Hitachi group, it can be said to serve as a "model." The company's growth rate has averaged 15 percent for the past 10 years. Compared to sales of 25.4 billion yen in FY1977, the company has enjoyed a big sweep and has doubled its sales in 5 years to 50.4 billion yen in FY82.

Primary business consists of computer and communication machine maintenance and installation work. Besides that, the company sells data processing devices and systems such as communication machines. The driving force of the sweeping growth is the maintenance of computers. This sector shows an annual 20 percent growth. Communication machines did not achieve such results.

The deciding factor in the maintenance business lies in "where and how many outposts shall be placed. After that, you only have to pour in men and parts." (President Shozo Sato) Since the opening of service stations in Osaka and Nagoya in 1964, the company had started to lay out a complete network of outposts, and established the present 2-branch and 12-sales-office system in 1976. Currently, there are 260 outposts throughout the nation. Until this system was established, the company was in the stage of investing for the future. Now the investment appears to have born fruit.

Of course, the company has not neglected to invest for the future. "Future intensification of competition cuts into our growth of income. How to operate efficiently is the issue with the maintenance business, which requires a pool of manpower." (President Sato) With that in mind, the company started an "assist system (remote diagnosis system): from January 1983 in order to establish a backup system.

The system is intended to discover computer disorders from a distance. This method does not require human services. For this purpose, a support center was built in a new corporate building in Totsuka, Yokohama. Although computers and communication machines are presently on the sunny side of the street, an effort for building this sober and modest system should not be overlooked.

Half of Technical Staffs Are Young People

Software companies are characteristically a collection of young engineers. In the Toshiba group, Toshiba Engineering is the leading software company. This company also has an outstanding record of achieving 9 consecutive years of income and profit increases in the group. For the past 5 years, sales and recurring profits showed an average growth of 20 percent and 30 percent, respectively. The driving force of the success was the computer software sector. The sales in this sector quadrupled to 5.5 billion yen in FY82 from 1.2-1.3 billion yen of 5 years ago. The sales percentage of the total sales was also raised from 15 percent to 25 percent.

With this sudden explosion in the computer software business, the company annually employs a large number of college engineering graduates, which transforms the company quickly into a young technical group. The employee percentage distribution as of April 1983 indicates 48 percent of the approximately 3,000 engineers are young men who have worked less than 4 years after college graduation and employment and who have worked less than 8 years since high school graduation.

The president of the company, Mr Hideyuki Matsui, took office only last June, but he looked over Toshiba Engineering 10 years ago when he was a manager of the heavy electric equipment division in his Toshiba days. Commenting on the transition over 10 years, "This company was originally set up to keep the technology of retired Toshiba workers. Now, it only has 100 Toshiba old boys. It is a young company, with young people constituting one-half of the 3,200 employees. The business content is also shifting to computer software." In the past several years, it has employed regularly 300 people a year, and the majority of the newly employed were engineers. Software technology requires intelligence. Ability differs from person to person. So much so that it is necessary to attract able human resources. It has a record of hiring a large number of software engineers, and is in an advantageous position to attract human resources. It has the potential to become, so to speak, a large mass of software engineers in the Toshiba group. In the future, the company will get into the field of mini-CAD and computerized test systems for medium and small businesses as "domains which befit our own characteristic" (President Matsui).

Business Management from Individual Corporate Management

Mitsubishi Electric launched a policy to enshrine the software companies at the core of the affiliated company management. So far, affiliated company management of Mitsubishi has been practiced on the basis of an individual company. The company is now trying to switch over to business management. In other words, a business structure of affiliated companies will be transformed. The envisioned business structure of the parent company 5 years in the future defines

that 50 percent of the sales shall be from the most advanced business field focusing on electronics, i.e., electronic merchandises such as computers, semiconductors, communications and AV [audiovisuals]. This business is attended with software in both designing and using stages. An additional characteristic is that the software determines the growth of hardware. That makes it more important for the presence of affiliated software companies. Presently there are seven software companies affiliated with Mitsubishi Electric. The company intends to manage the software business group with priority through the president's office and the office of affiliated companies in order to fabricate a closely tied parent-child relationship to develop an efficient business.

Rush to Independence

These trends can be perceived as a sign that the "industrial structure" of the Hitachi, Toshiba and Mitsubishi Electric groups will rapidly shift toward the software and service fields. What triggered the shift to the software and service business was the introduction of electronics. With the progress of semiconductor technology, microcomputers invaded factories, offices, homes and communities. Automation of these elements is indiscriminately accompanied by software and services. Consequently these fields broaden unchecked. It is natural that these trends are so explicitely visible in the "individual structure" of Hitachi, Toshiba and Mitsubishi Electric, since they are particularly expeditious in shifting to electronics.

However, it is necessary for these software and service companies to become independent from their parent company in order for them to play a truly main role in the renovation of the group's "industrial structure" while experiencing the transition. In the past, the influential companies in the groups expanded business on their own without heavily depending on the parent company. Hitachi Maxell and Tokyo Electric are good examples. Hitachi Electronics Service has formulated a policy to raise the self-sales ratio (sales of data processing machines and systems) to 20 percent from the current 10 percent, reasoning that "whatever we can expand by ourselves we will do by ourselves." Toshiba Engineering also hopes "to in rease the self-sales ratio to 30 percent in FY86 from the present 15 percent" (President Matsui). In the case of this company, half of the self-sales is shared by computer software. The company wishes to use this product as a lever for the expansion of self-sales. Mitsubishi Electric, on the other hand, intends to raise the external sales ratio of the group business.

The "tripod" of the Hitachi group used to be Hitachi Metals, Hitachi Chemical and Hitachi Cable. They are all raw material-related production companies. At present, Hitachi Maxell, Hitachi Credit and Nissei Sangyo are called the "new tripod." Only Hitachi Maxell is a production company, and production is related to electronics, as easily expected. Demotion of the manufacturing business is clearly demonstrated. It reflects the trend of the times. If ever a "new new tripod" is to spring up in the future, it will probably be from the software-related and service fields. In this case Hitachi Electronics Service may pose as the leading "family of good standing." It, after all, needs independence to acquire that status.

Emerging Software and Service Companies

A 日立グループ			B 東芝グループ			C 三菱電機グループ		
a	社名	b 申告所得	a	社名	b 申告所得	a	社名	b 申告所得
1	日立製作所	1618	1	東京芝浦電気	963	1	三菱電機	508
2	日立マクセル	307	2	東芝機械	84	2	菱電サービス	141
3	日立クレジット	174	3	東京電気	64	3	菱電運輸	10
4	日立電線	173	4	東芝プラント建設	40	4	菱電エンジニアリング	9
5	日立金属	146	5	東芝セラミックス	34	5	菱電サービスセンター	9
6	日立エレベーターサービス	103	6	東芝タンガロイ	30	6	島田理化工業	6
7	日立家電販売	103	7	昭和電線電纜	27	7	菱電不動産	5
8	日立建機	89	8	東芝イーエムアイ	26	8	菱和商工	4
9	日製産業	78	9	東京光学機械	21	9	弘電社	3
10	日本コロムビア	76	10	東芝メディカル	20	10	アド・メルコ	2
11	日立電子サービス	72	11	東芝クレジット	18	11	メルコムビジネス	2
12	日立運輸	68	12	西芝電機	18	12	東洋電機	2
13	日立工機	52	13	東芝エンジニアリング	13	13	菱電エレベータ施設	2
14	日立化成工業	51	14	テック電子	12	14	菱電印刷	1
15	日立プラント建設	50	15	東芝熱器具	11	15	メルコムサービス	1

c 注：申告所得は57年中に申告したもの。単位億円。

Key:

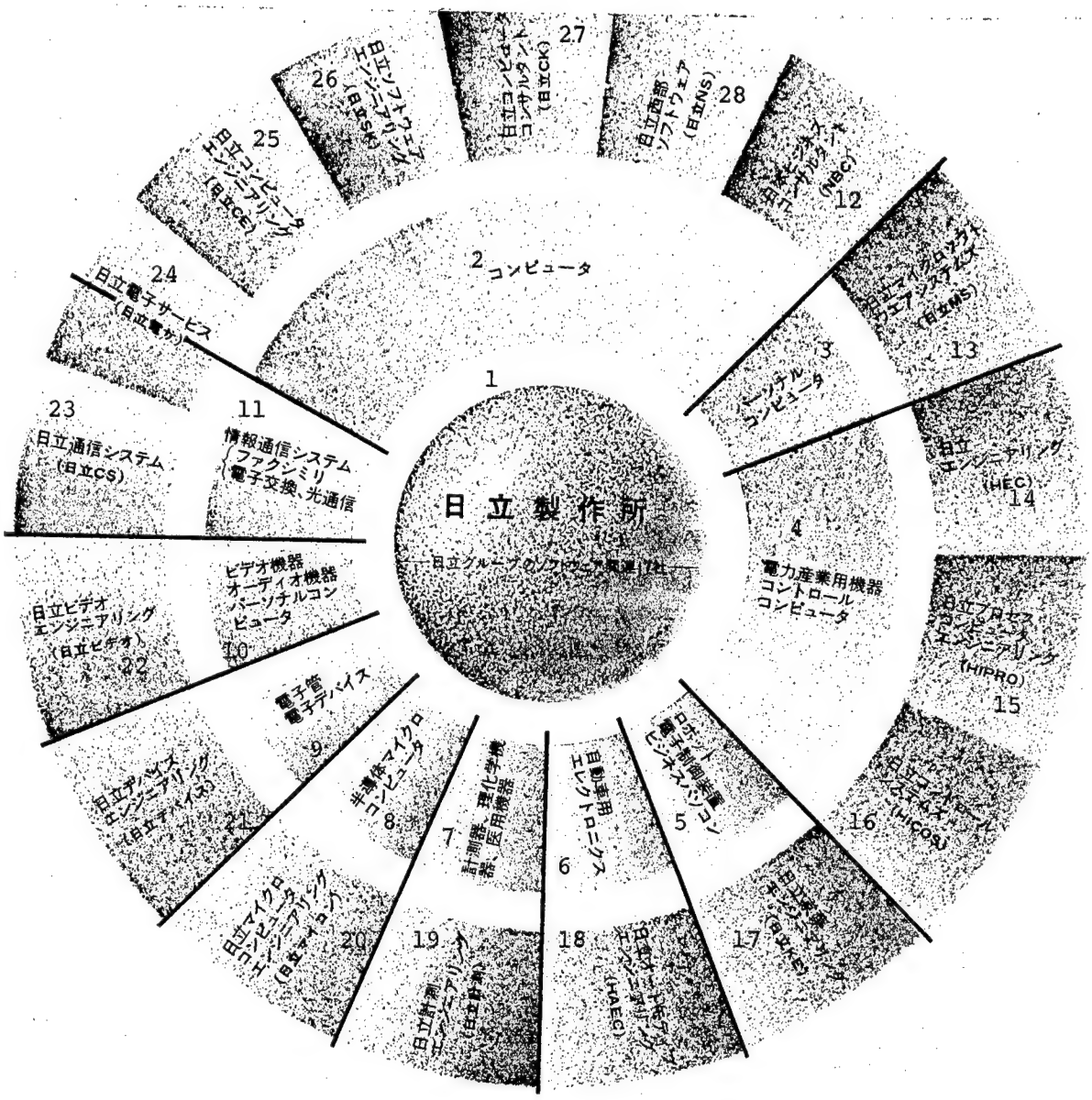
A. Hitachi group
a. Company name
b. Income reported
1. Hitachi, Ltd.
2. Hitachi Maxell
3. Hitachi Credit
4. Hitachi Cable
5. Hitachi Metals
6. Hitachi Elevator Service
7. Hitachi Sales
8. Hitachi Kenki
9. Nissei Sangyo
10. Hitachi Columbia
11. Hitachi Denshi Service
12. Hitachi Unyu
13. Hitachi Koki
14. Hitachi Chemical
15. Hitachi Plant Engineering and Construction

B. Toshiba group
a. Company name
b. Income reported
1. Toshiba Corp.
2. Toshiba Machine
3. Tokyo Electric
4. Toshiba Plant Engineering and Construction
5. Toshiba Ceramics
6. Toshiba Tangaloy
7. Showa Electric Wire & Cable
8. Toshiba EMI
9. Tokyo Kogaku Kikai
10. Toshiba Medical
11. Toshiba Credit
12. Nishishiba Denki
13. Toshiba Engineering
14. Tec Electronics Corporation
15. Toshiba Netsu Kigu

C. Mitsubishi Electric group
a. Company name
b. Income reported
1. Mitsubishi Electric
2. Ryoden Service
3. Ryoden Unyu
4. Ryoden Engineering
5. Ryoden Service Center
6. Shimade Rika Kogyo
7. Ryoden Fudosan
8. Ryowa Shoko
9. Kodensha
10. Ad Melco
11. Melcom Business
12. Toyo Denki
13. Ryoden Elevator Fusetsu
14. Ryoden Insatsu
15. Melcom Service

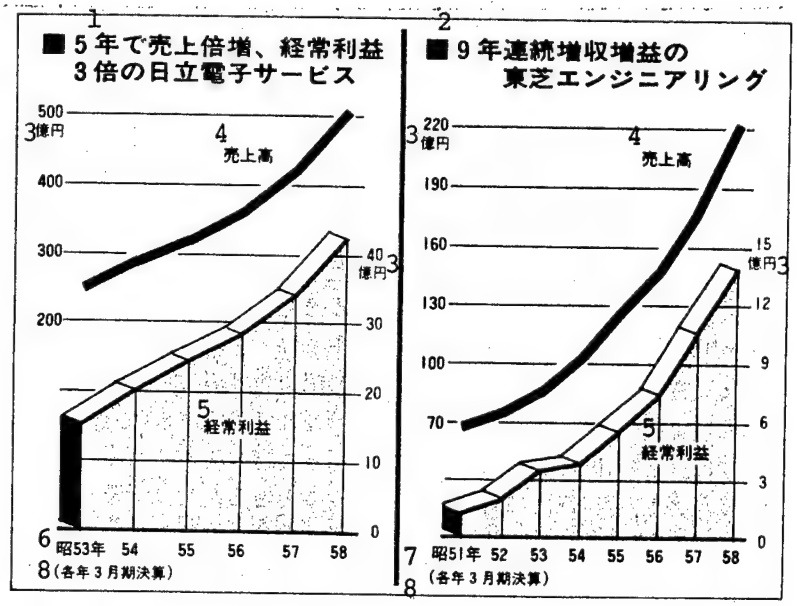
c. Note: Reported income of 1982; unit: 100 million yen

Electronics Age Requiring Software and Services in All Fields

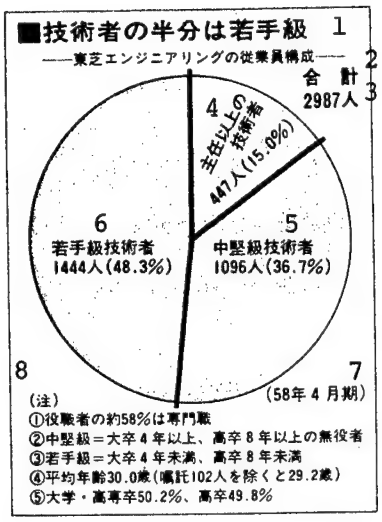


Key:
1. Hitachi, Ltd., - 17 Software-related Companies in the Hitachi Group
2. Computer
3. Personal computer
4. Power industry machinery controls and computers
5. Robot electronic-control devices, business personal computers
6. Automotive electronics
7. Instruments, physical and chemical apparatus
8. Semiconductor microcomputers
9. Electronic tubes and electronic devices

Key: 10. Video equipment, audio equipment, personal computers
11. Data communications systems (facsimile, electronic exchange, optical communications)
12. Nippon Business Consultant
13. Hitachi Microsoftware Systems (Hitachi MS)
14. Hitachi Engineering
15. Hitachi Process Computer Engineering
16. Hitachi Control Systems
17. Hitachi Keiyo Engineering (Hitachi KE)
18. Hitachi Automotive Engineering
19. Hitachi Keisoku Engineering (Hitachi Keisoku)
20. Hitachi Microcomputer Engineering (Hitachi Micon)
21. Hitachi Device Engineering (Hitachi Device)
22. Hitachi Video Engineering
23. Hitachi Communications System
24. Hitachi Denshi Service (Hitachi Densa)
25. Hitachi Computer Engineering (Hitachi CE)
26. Hitachi Software Engineering (Hitachi SK)
27. Hitachi Computer Consultant (Hitachi CK)
28. Hitachi Seibu Software (Hitachi NS)



Key: 1. Hitachi Denshi Service Doubling Sales and Tripling Operational Profits in 5 Years
2. Toshiba Engineering with 9 Consecutive Years of Income and Profit Increase
3. 100 million yen
4. Sales
5. Operational profit
6. 1978
7. 1976
8. Accounting term ending in March every year



Key:
1. Half of Engineers Are Young
2. Toshiba Engineering's employee composition
3. Total: 2,987 people
4. Engineers above chief engineers
5. Medium-standing engineers
6. Young engineers
7. Term ending April 1983
8. Note: (1) Approximately 58 percent of supervisors are professionals. (2) Medium-standing class: non-supervisory position with work experience more than 4 years after college graduation and more than 8 years after high school. (3) Young class: work experience of less than 4 years after college graduation and less than 8 years after high school. (4) Average age: 30.0 (29.2, excluding 102 contractors). (5) Graduates of college and higher school--50.2%; high school graduates--49.8%.

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ECONOMIC

LEADING INDUSTRIES, PRINCIPAL BUSINESS EXECUTIVES RATED

Tokyo SHUKAN DAIYAMONDO in Japanese 13-20 Aug 83 pp 54-63

[Text] Toyota and Kyocera

The evaluations and observations that 500 top business executives have made about the Toyota Motor Co and Kyocera Corp are overwhelming. But the very interesting fact is that their view on the future of these two companies is turning around.

Although Toyota Motors took 1st place, with an overwheming 153 votes, in the enterprise for reference category in the ratings for its all-round management ability, it slipped to 4th place with 29 votes in the category of company presently being observed and tumbled further down to 10th place in the company-to-watch in 5 to 10 years category. On the other hand, the case of Kyocera is the opposite.

Kyocera ranks 4th with 56 votes in the enterprise for reference category ratings of its management ability; however, with 129 votes as an enterprise-to-watch, it outranks by a wide margin, the 2d ranking Nippon Electric Co, Ltd. It also received 142 votes as an enterprise-to-watch in 5 to 10 years category. Thus, it shows an overwhelming ability to get attention and to project its future image. Such a reverse phenomenon with Toyota Motors is very interesting.

The same phenomenon can be observed in the case of Matsushita Electrical Industrial Co, Ltd, which ranks 2d with 114 votes in the enterprise for reference category. Matsushita Electrical tumbles to below the 10th place as an enterprise-to-watch both for now and in the future. As an enterprise for reference, the Kajima Construction Company is occupying a powerful position but it is near zero as a company-to-watch.

On the other hand, as in the case of Kyocera, Fujitsu, Ltd, Kyowa Hakko Kogyo Co, Ltd, Sumitomo Electric Industries, Ltd, and Nippon IBM are in each case getting much attention, and they are viewed as enterprises with room for future expansion. Especially, Nippon Telegraph and Telephone Public Corporation, which ranks below 70th, with only 3 votes, as an enterprise for reference, but moves up abruptly to 4th with 44 votes in the category of enterprise-to-watch in the future.

In general, among the enterprises which have been rated as stable in these three categories of evaluation, the reference enterprise and the enterprise-to-watch (present and future), Nippon Electric Co, Ltd, continues to receive high votes as a somewhat ideal type of enterprise. Also stable are Nomura Securities Co, Ltd, the Sharp Corporation, Toray Industries, Inc, the Honda Motor Co, Ltd, Canon, Inc, and Asahi Chemical Industries Co, Ltd.

It becomes clear that a trend emerges from such a series of evaluations because of reasons (rating points) to be discussed later. But what can be said right at this point is that many executives have had some slight misgivings about the future of the management of giant enterprises, particularly on the question of whether or not the giant enterprises will still be able to maintain the present level of management ability and continue their noteworthy activities.

Enterprises With Low Ratings

Among the enterprises to be used as reference on the basis of the ratings of their all-around management abilities, Toyota, Matsushita, and Hitachi Ltd are the three giants. Each of these, without exception, received votes from the firms in the same line of industry. The four companies, Kyocera, the Sumitomo Bank, Suntory and Nippon Electric, belong to the giant class.

If one is to pick the five best industries, receiving the most favorable ratings from each of the principal industries, the result is interesting. (see Table 9)

Among the financial institutions, the one that received the most favorable ratings was the Sumitomo Bank for its training of promising personnel, its practice of placing the right man in the right place, and its earning power. It is followed by Toyota, Matsushita, Nomura, and Hitachi. Nomura Securities received high ratings for its ability to cope with changes and for its management ability. Surprisingly, the Dai Ichi Kangyo Bank, which has the highest amount of deposits, and the famous Mitsubishi Bank both failed to receive any votes. In the chemical and pharmaceutical industries, Toyota and Hitachi were followed by third-ranking Toray Industries, which has wisely switched from textiles, and has thus won recognition for its management renovation ability. It is followed by the Fuji Photo Film Co, Ltd, and Kyocera whose abilities in technical developments have been recognized.

In the electrical machinery industry, ratings show a line-up of Matsushita, Toyota, and Hitachi, who are followed by Kyocera, as fourth, then Suntory, and then Sharp. Suntory got high ratings for its marketing ability and vitality. In the automobile and transport machinery industry, the ranking is as follows: Toyota, Matsushita, Hitachi, Kyocera, and a three-way tie for fifth place--Honda, Fujitsu, and Sony. Honda got points for its business vitality, its ability to act and its development ability.

The ranking in the distribution industry was as follows: Toyota, Hitachi, Matsushita, the Seibu Department Store Co, and Suntory. The Seibu Department

Store Co was recognized for its vitality and ability to cope with changes. A very interesting fact was that contrary to expectations, the Daiei Co, Ltd and Ito Yoka Do, Ltd, the leading firms in the distribution industry, received almost no votes from other firms in the same line of industry.

Strangely, besides the cases in the financial and distribution fields as mentioned earlier, those top class industries which failed to receive any points from firms in the same line of industry were the following: Sumitomo Chemical Co and the Taisyo Pharmaceutical Co, in the field of chemical industry; Toshiba in the electrical machinery industry; and the Nissan Motor Co and Mitsubishi Heavy Industries, Ltd, in automobile and transportation machinery industry.

Tables 2, 3 and 4 show the order of reasons given in the selection of certain enterprises to be used as references on the basis of evaluations. Those categories which received more than 100 votes are: first of all, the category of technical development ability. Five others which follow are: the ability to manage, the ability to respond to changes flexibly, the ability to merchandise and market, the vitality and the ability to act, and the ability to sell and to do business.

If these reasons are closely examined, it is understandable why the weight of evaluations on enterprises is given on the strength of management and technology and their mobility and vitality.

Industry Change Foreseen

At present, the top five enterprises-to-watch are the dominant Kyocera Corp followed by Nippon Electric, Fujitsu, Toyota, and the Seibu Department Stores. Regardless of their sizes, each of these firms received uniform ratings.

Although Kyocera Corp, the number one enterprise-to-watch, has been particularly popular among the industries established in the post-war period, much attention is also being paid to the traditional enterprises established in the Meiji period. With the operation of an express home delivery service, the Yamato Transport has moved beyond the traditional bounds of the transportation industry. Accordingly, its system which responded to changing times has attracted the attention of other business executives. As an old enterprise established during the Meiji period, it attracts an unusual interest from other industries.

When the enterprises under evaluation were analyzed in terms of their periods of establishment, the one which was most popular of the enterprises established in 1965-75 is the Seibu Department Stores. Perhaps the young businesses must be attracted to the new sensitivity of the Seibu. When it comes to the enterprises established in 1955-65, Fanuc, Ltd, is the one. When it comes to 1945-55), TDK and Canon Inc are the ones. An interesting point is that the enterprise-to-watch changes according to the history of the evaluating enterprises. Moreover, in the enterprises of medium standing, the World Computer Service and Yamazaki Iron Works attracted a high level of attention.

As the companies-to-watch in 5 to 10 years, Kyocera Corp, Nippon Electric, Fujitsu, Hitachi, and the Nippon Telegraph and Telephone Public Corporation are the top five. The frontier technology-related industries such as Kyowa Hakko Kogyo, Fanuc, Ltd and Nippon IBM rank sixth, seventh and eighth, respectively. Perhaps such a lineup may portend changes in the future structure of industry.

Management God Is Well

As "ordinarily the most respected executive and the executive to follow," Mr Matsushita Konosuke was chosen by slightly less than 30 percent of the 500 foremost business executives. With 140 votes, the number is overwhelming in comparison with Mr Doko Toshio who is in 2d place with 55 votes, and Mr Honda Shoichiro in 3d place with 16 votes.

Since this survey, in which currently active business executives select the executives that they most respect, was the first of its kind, the results were watched with keen interest. The popularity of Mr Matsushita Konosuke was as strong as ever. Also, in view of the size of those industries and their presidents, the support that Mr Matsushita received was evidently broadbased.

Fascination for the Matsushita cult is proven with such comments about him as the "god of management philosophy" or the "perfected executive." When one pays attention to the more specific comments on Matsushita, many point out his success as a businessman by saying that, "He nurtured his business from a town factory to today's giant," or, "He turned the old Matsushita into a highly profitable enterprise." Still others seem to be attracted to him because, "He does not become obstinate," or, "He is attractive as a human being."

The 10 most respected businessmen are shown on the separate table. Among them are four of the original founders of their respective enterprises. They are first of all Mr Matsushita, followed by Honda Shoichiro, Ito Masatoshi, and Morida Akio. Mr Honda is reputed to "possess the romanticism and the philosophy of the executive," and, "to have superior enterpreneurial spirit, coupled with vigor of research-mindedness." The executives all agree that although he was the original founder of the Honda enterprise, Mr Honda maintained a refreshing personnel policy without falling into the pitfall of clan management.

He must be the type of executive liked by the Japanese people who value the gracefulness of those who face retirement. This also shows how difficult it is for the people in power to make a right move.

Doko Toshio is 86 years old. He is the honorary president of Keidanren (Federation of Economic Organizations), and the man behind the administrative reform. His popularity is great because he is a man of integrity, firmness; he is selflessly impartial, and moreover, he is a manager with backbone and vitality. It is particularly noteworthy that much of his support came from the executives of the Taisho generation. Along with Doko, Sakurada Takeshi, the honorary president of the Nikkeiren (Japan Federation of Employers' Association), it is in the top 10, but ranks 8th. The reason for his inclusion in the top 10 is that,"He has a firm management ideal" and, "He has a sound management record at the Nisshin Spinning Co, Ltd."

Isoda Ichiro

Among the currently active executives, the one who is most feared and respected is Isoda Ichiro, the president of the Sumitomo Bank.

Last year, Mr Isoda received a "Banker of the Year" award, given to the banker who achieves the most in banking worldwide. The reason for the award was in recognition of his ability as executive officer in turning the Sumitomo Bank into the most profitable bank after surmounting the crisis surrounding the Antaku Sangyo affair.

The award winner was decided by an opinion survey of 160 leading bankers, worldwide, but Mr Isoda's management ability, particularly his "decisiveness and leadership displayed in overcoming the difficulty," his "direction and judgment" and his "ability to see through the essence of business management," has been highly regarded even among Japanese executives. Incidentally, it may be pointed out that among the ranking active frontline executives, such faces as Mr Isoda, Kobayashi Koji (president of Nippon Electric Co), Tsubouchi Hisao (president of the Kurushima Dock), Ito Masatoshi (president of the Ito Yoka Do, Ltd), Morida Akio (president of the Sony Corporation), and Toyota Eiji (president of the Toyota Motor Co) are seen.

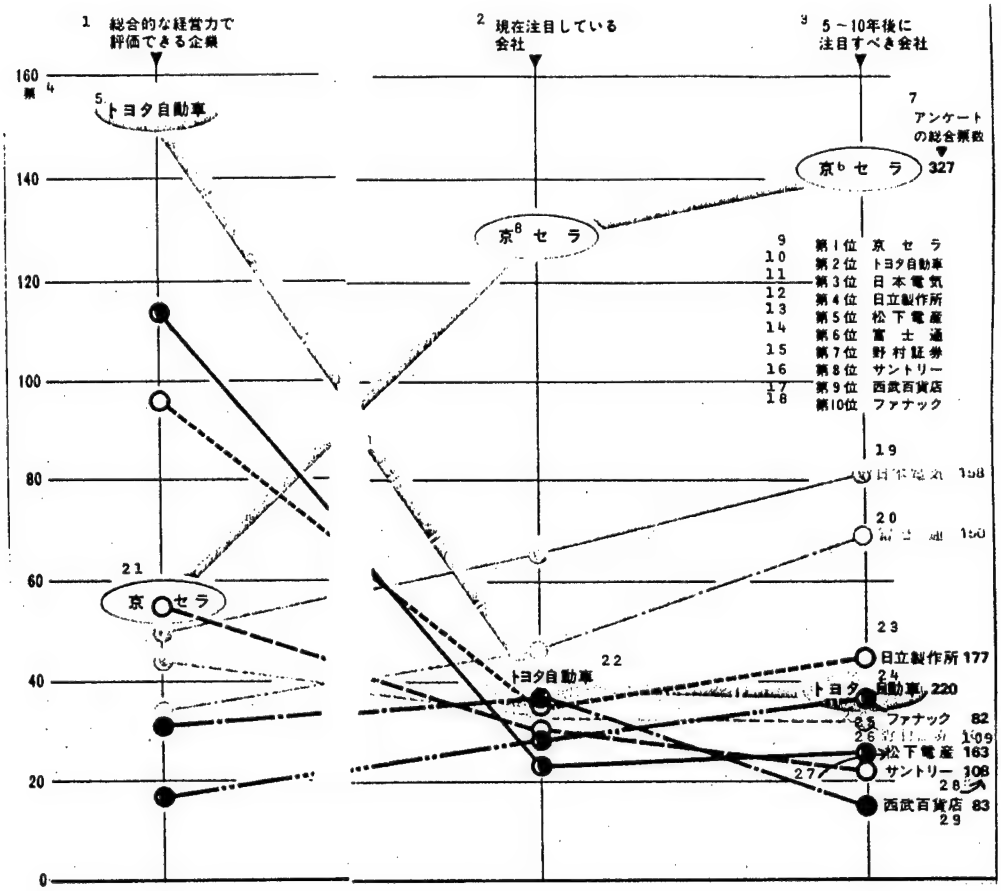
Mr Kobayashi has shown his "superior foresight and leadership," and Mr Tsubouchi has "carried through his firm belief" and maintained a "rational and efficient management."

Mr Morida of the Sony Corporation, who is popular among the young executives for being a man of action, for his "wide vision" and "his record of achievement in nurturing international enterprise," attracted recognition. On the other hand, Mr Toyota of the Toyota Motor Co is reputed to have effected a thorough and rational management policy. He also possesses foresight, organizational ability, and a sense of balance in management. He is popular among the executives of the Taisho generation.

If the list of the respected executives is expanded to include first 20, Shibuzawa Eiichi ranks 11th followed by Yoshita Tadao (president of the Yoshida Kogyo Co), Maruda Yoshio (president of the Kao Soap Co, Ltd), Inamori Kazuo (president of the Kyocera Corp, Tsutsumi Seiji (representative of the Seibu Distribution Group), and Oyama Umeo (president of the Tsugami Mfg Co, Ltd), 12th through 16th respectively. Matsunaga Ansaemon ranks 17th followed by Kamei Masao (president of the Sumitomo Electric Industries, Ltd), Nakauchi Isao (president of the Daiei Co, Ltd), and Saji Keiso (president of the Suntory) in order. Although Tsubouchi Hisao and Oyama Umeo are cited for their successful rebuilding of their enterprises; unfortunately, Mr Hayakawa Tanezo was unable to get even one vote. Despite the high level of attention given to Kyocera Corp, President Inamori did not receive many votes. This means that evaluations of him as an executive will be made hereafter.

From the distribution industry, three executives such as Ito Masatoshi, Tsutsumi Seiji, and Nakauchi Isao have been selected, but the reason for their selection is contrasting. Mr Ito was selected for his "modesty and temperately sound" attitude, in contrast with Mr Tsutsumi whose strength was his "high level of cultural knowledge and versatility," Mr Nakauchi received points for his "positive attitude" and "personification of romanticism."

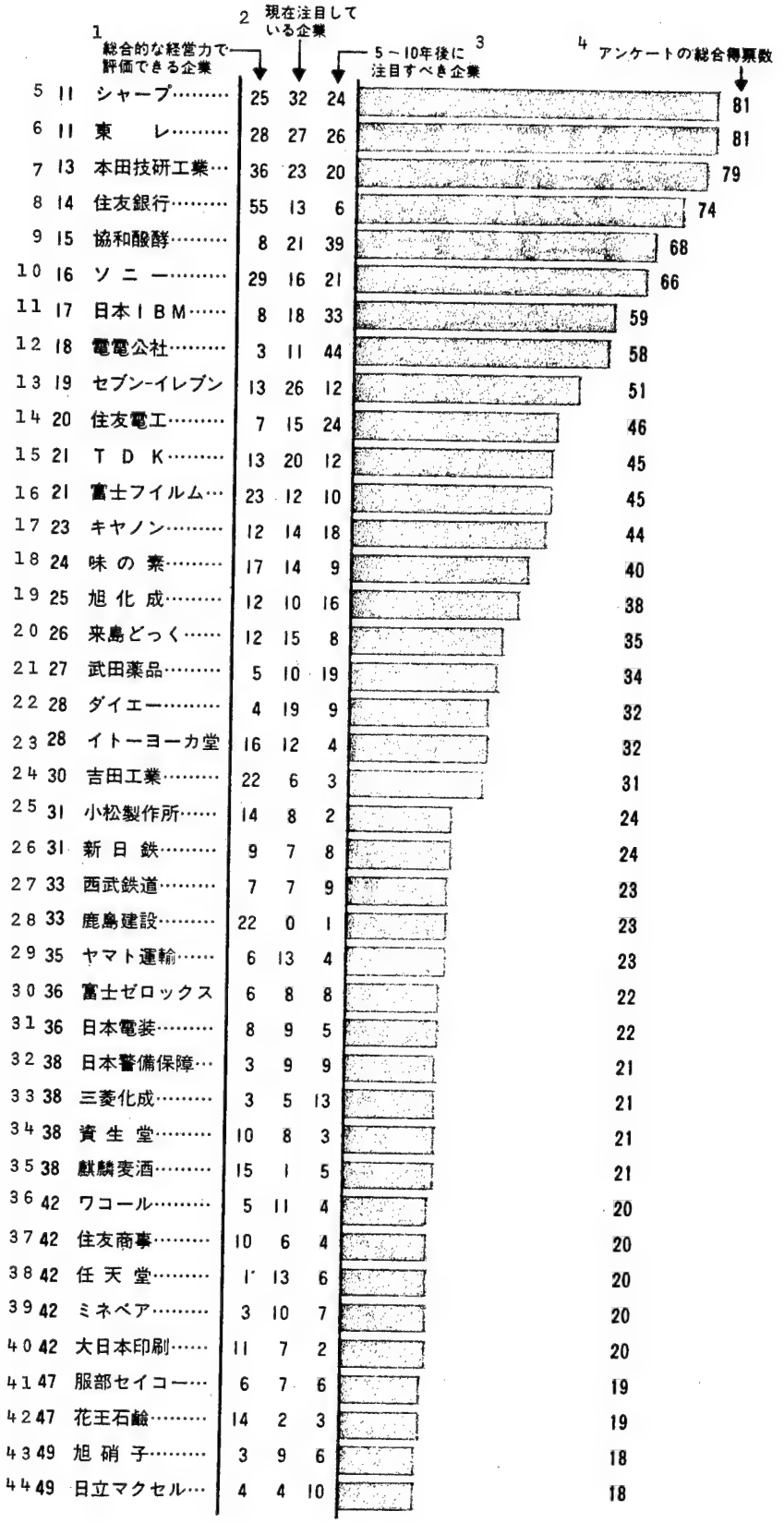
Table 1. Good Contrast Between Toyota (Popularity Declines Hereafter) and Kyocera Corporation (Promising Stocks Hereafter)



Key:

1. Enterprises which can be rated on the basis of all-around management ability
2. Companies presently under observation
3. Companies-to-watch in 5 to 10 years henceforth
4. Vote
5. Toyota Motors
6. Kyocera
7. Combined total votes of opinionaire
8. Kyocera
9. 1st place Kyocera
10. 2d place Toyota Motors
11. 3d place Nippon Electric
12. 4th place Hitachi, Ltd.
13. 5th place Matsushita Electric Industries Co
14. 6th place Fujitsu, Ltd.
15. 7th place Nomura Securities
16. 8th place Suntory
17. 9th place Seibu Department Stores
18. 10th place Fanuc, Ltd.
19. Nippon Electric
20. Fujitsu
21. Kyocera
22. Toyota Motors
23. Hitachi, Ltd.
24. Toyota Motors
25. Fanuc, Ltd.
26. Nomura Securities
27. Matsushita Electric Industries
28. Suntory
29. Seibu Department Stores

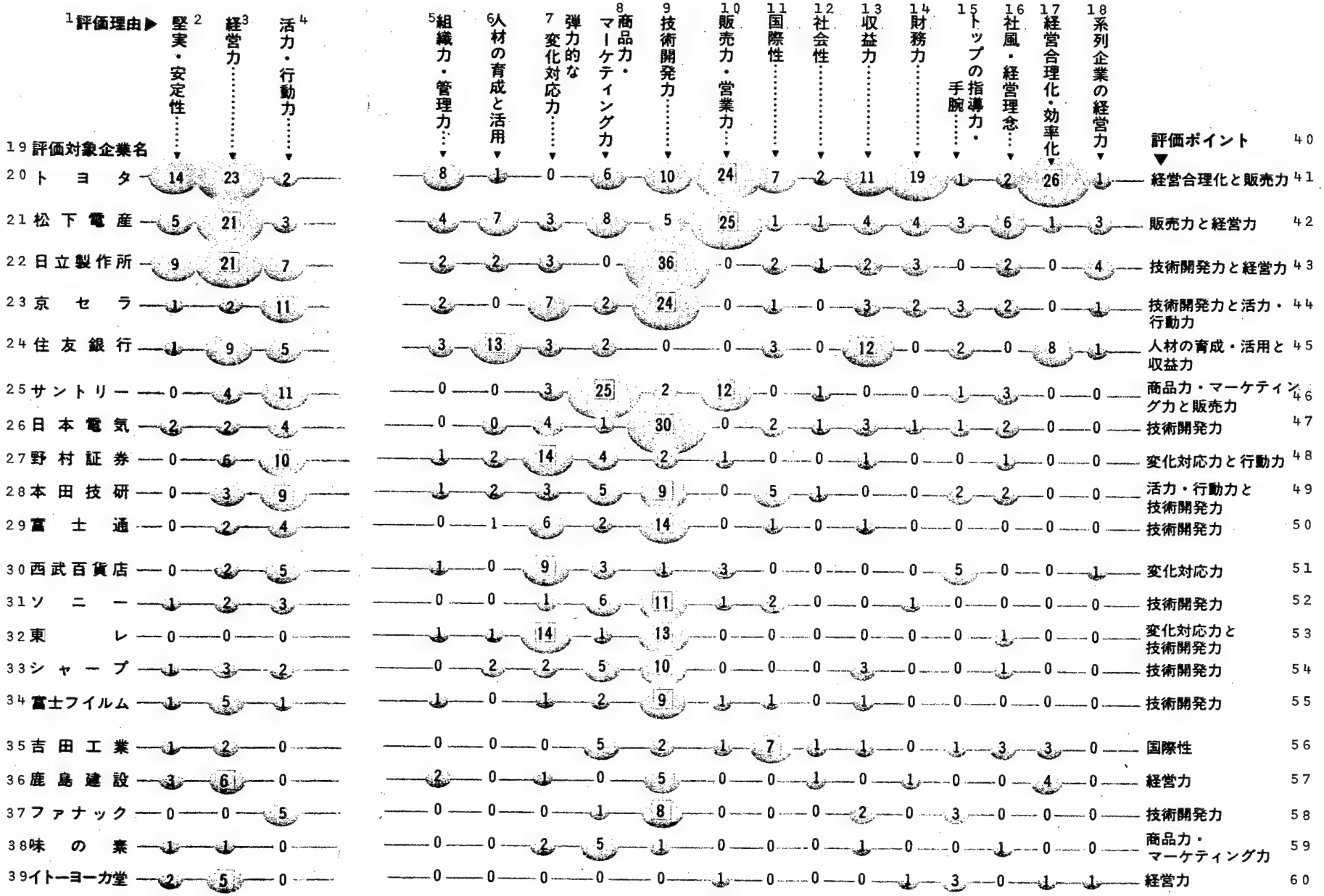
Table 2. Enterprises Concerned. Overall Rankings of Those Enterprises Rated



Key: [Table 2]

1. Enterprises that can be rated on the basis of all-around management abilities
2. Enterprises presently under observation
3. Enterprises-to-watch in 5 to 10 years
4. Combined total number of votes of opinionaire
5. Sharp Corporation
6. Toray Industries
7. Honda Motors
8. Sumitomo Bank
9. Kyowa Hakko Kogyo
10. Sony Corporation
11. Nippon IBM
12. Nippon Telegraph and Telephone Public Corporation
13. Seven-Eleven
14. Sumitomo Electric Industries
15. TDK
16. Fuji Photo Film
17. Canon, Inc
18. Ajinomoto Co
19. Asahi Chemical Industries
20. Kurushima Dock
21. Takeda Chemical Industries
22. Daiei Co
23. Ito Yoka Do, Ltd
24. Yoshida Kogyo
25. Komatsu, Ltd
26. Nippon Steel Corporation
27. Seibu Railway
28. Kajima Corporation
29. Yamato Transport
30. Fuji Xerox
31. Nippon Denso Co
32. Nippon Keibi Hosho
33. Mitsubishi Chemical Industries
34. Shiseido Co
35. Kirin Brewery Co
36. Wacoal Co
37. Sumitomo Shoji Kaisha
38. Nintendo Playing Card Co
39. Minebea Co, Ltd
40. Dai Nippon Printing Co
41. Hattori Seiko
42. Kao Soap Co
43. Asahi Glass Co
44. Hitachi Maxell

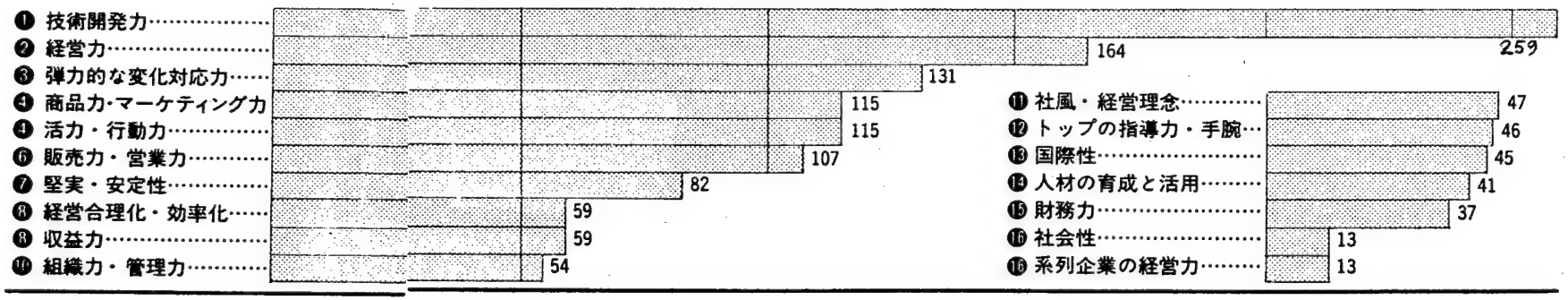
Table 3. Enterprises Which Can Be Rated on the Basis of All-round Management Ability



Key: [Table 3]

1. Reasons for rating
2. Soundness and stability
3. Management ability
4. Vitality and ability to act
5. Organization and control
6. Training of talented personnel and their efficient use
7. Ability to respond to changes elastically
8. Merchandising and marketing abilities
9. Technical development ability
10. Sales and business ability
11. Internationalism
12. Sociality
13. Profitability
14. Financial management ability
15. Leadership ability of top executives
16. Company style/atmosphere and management ideal
17. Rationalization of management and efficiency
18. Management ability of related enterprises
19. Enterprises under evaluation
20. Toyota
21. Matsushita Electric Industries
22. Hitachi, Ltd
23. Kyocera
24. Sumitomo Bank
25. Suntory
26. Nippon Electric
27. Nomura Securities
28. Honda Motors
29. Fujitsu
30. Seibu Department Stores
31. Sony
32. Toray Industries
33. Sharp
34. Fuji Photo Film
35. Yoshida Kogyo
36. Kajima Corporation
37. Fanuc, Ltd
38. Ajinomoto
39. Ito Yoka Do Ltd
40. Rating point
41. Rationalization of management and sales ability
42. Sales and management abilities
43. Technical development and management ability
44. Technical development ability, vitality and ability to act
45. Training of talented personnel, their efficient use, and profitability
46. Merchandising, marketing and sales abilities
47. Technical development ability
48. Ability to respond to changes and ability to act
49. Vitality, ability to act, and technical development ability
50. Technical development ability
51. Ability to respond to changes
52. Technical development ability
53. Ability to respond to changes and technical development ability
54. Technical development ability
55. Technical development ability
56. Internationalism
57. Management ability
58. Technical development ability
59. Merchandising and marketing ability
60. Management ability

Table 4. Technical Development, Management Ability, and the Ability To Respond to Changes (The ranking of the reasons)
Note: The number in the black dot indicates the order

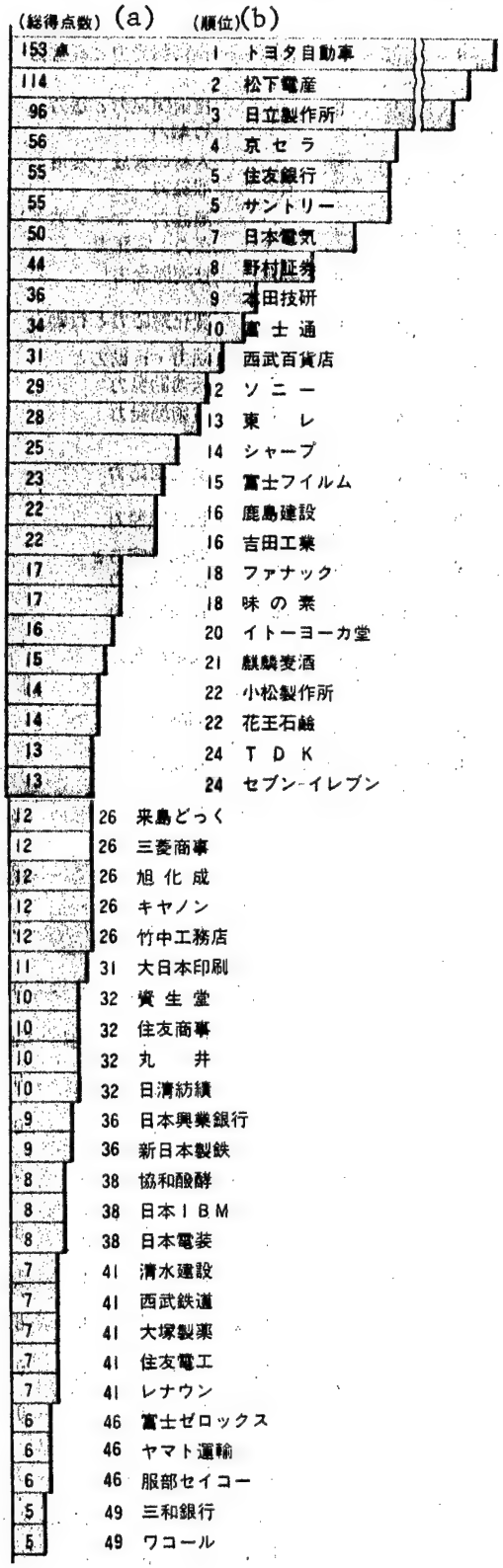


Key:

1. Technical development ability
2. Management ability
3. Ability to respond to changes elastically
4. Merchandising and marketing ability
4. Vitality and ability to act
6. Sales and business abilities
7. Soundness and stability
8. Rationalization of management and efficiency
8. Profitability
10. Organization and control
11. Company style/atmosphere and management level
12. Leadership ability of top executives
13. Internationalism
14. Training of talented personnel and their efficient use
15. Financial management ability
16. Sociality
17. Management ability of related enterprises

[Keyed numbers correspond to numbers in black dots]

Table 5. Enterprises for Reference (enterprises which can be rated on the basis of all-around management ability)



(総得点数) (a)	(順位)(b)		(a) Total points won (b) order
153点	1	トヨタ自動車	Toyota Motors
114	2	松下電産	Matsushita Electric Industries
96	3	日立製作所	Hitachi, Ltd
56	4	京セラ	Kyocera
55	5	住友銀行	Sumitomo Bank
55	5	サントリー	Suntory
50	7	日本電気	Nippon Electric
44	8	野村証券	Nomura Securities
36	9	本田技研	Honda Motors
34	10	富士通	Fujitsu
31	11	西武百貨店	Seibu Department Stores
29	12	ソニー	Sony
28	13	東レ	Toray Industries
25	14	シャープ	Sharp
23	15	富士フイルム	Fuji Photo Film
22	16	鹿島建設	Kajima Corporation
22	16	吉田工業	Yoshida Kogyo
17	18	ファナック	Fanuc, Ltd
17	18	味の素	Ajinomoto Co
16	20	イトーヨーカ堂	Ito Yoka Do, Ltd
15	21	麒麟麦酒	Kirin Brewery
14	22	小松製作所	Komatsu Ltd
14	22	花王石鹸	Kao Soap
13	24	TDK	
13	24	セブン-イレブン	Seven Eleven
12	26	来島どっく	Kurushima Dock
12	26	三菱商事	Mitsubishi Corporation
12	26	旭化成	Asahi Chemical Industries
12	26	キヤノン	Canon
12	26	竹中工務店	Takenaka Komuten Co
11	31	大日本印刷	Dai Nippon Printing
10	32	資生堂	Shiseido
10	32	住友商事	Sumitomo Shoji
10	32	丸井	Marui Co
10	32	日清紡績	Nisshin Spinning Co
9	36	日本興業銀行	The Industrial Bank of Japan
9	36	新日本製鉄	Nippon Steel
8	38	協和醗酵	Kyowa Hakko Kogyo
8	38	日本IBM	Nippon IBM
8	38	日本電装	Nippon Denso Co
7	41	清水建設	The Shimizu Construction Co
7	41	西武鉄道	Seibu Railway Co
7	41	大塚製薬	Ozuka Pharmaceutical
7	41	住友電工	Sumitomo Electric Industries
7	41	レナウン	Renoun, Inc
6	46	富士ゼロックス	Fuji Xerox
6	46	ヤマト運輸	Yamato Transport
6	46	服部セイコー	Hattori Seiko
5	49	三和銀行	The Sanwa Bank
5	49	ワコール	Wacoal Co

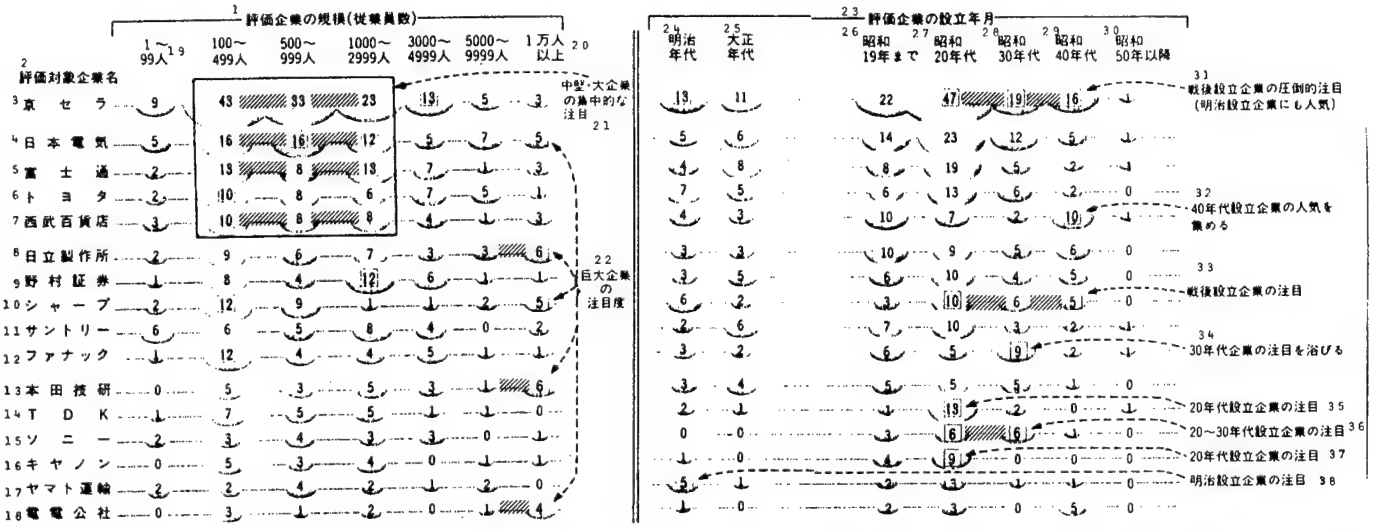
Table 6. Enterprises Under Observation (present)

Total points won	Order		
129点	1	京セラ	Kyocera
66	2	日本電気	Nippon Electric
47	3	富士通	Fujitsu
39	4	トヨタ自動車	Toyota Motors
37	5	西武百貨店	Seibu Department Store
36	6	日立製作所	Hitachi, Ltd
33	7	野村証券	Nomura Securities
32	8	シャープ	Sharp
31	9	サントリー	Suntory
28	10	ファナック	Fanuc, Ltd
27	11	東レ	Toray Industries
26	12	セブン イレブン	Seven Eleven
23	13	本田技研工業	Honda Motors
23	13	松下電産	Matsushita Electric Industries
21	15	協和醗酵	Kyowa Hakko Kogyo
20	16	TDK	
19	17	ダイエー	Daiei
18	18	日本IBM	Nippon IBM
16	19	ソニー	Sony
15	20	来島どっく	Kurushima Dock
15	20	住友電工	Sumitomo Electric Industries
14	22	味の素	Ajinomoto
14	22	キヤノン	Canon
13	24	任天堂	Nintendo Playing Card
13	24	住友銀行	Sumitomo Bank
13	24	ヤマト運輸	Yamto Transport
12	27	富士フイルム	Fuji Photo Film
12	27	イトーヨーカ堂	Ito Yoka Do, Ltd
11	29	ワコール	Wacoal
11	29	電電公社	Nippon Telegraph and Telephone
10	31	帝人	Teijin, Ltd
10	31	ミネベア	Minebea Co, Ltd
10	31	武田薬品	Takeda Chemical Industries
9	34	日本電装	Nippon Denso
9	34	日本警備保障	Nippon Keibi Hosho
9	34	旭硝子	Asahi Glass
9	34	カシオ計算機	Casio Computer Co
8	38	資生堂	Shiseido
8	38	富士ゼロックス	Fuji Xerox
8	38	小松製作所	Komatsu, Ltd
8	38	日産自動車	Nissan Motors
7	42	新日本製鉄	Nippon Motors
7	42	アシックス	Asics Corp
7	42	服部セイコー	Hattori Seiko
7	42	ミサワホーム	Misawa Home
7	42	西武鉄道	Seibu Railway
7	42	大日本印刷	Dai Nippon Printing
7	42	野村証券	Nomura Securities
7	42	美津濃	Mizuno
7	42	オリエントファイナンス	Orient Finance

Table 7. Enterprises Under Observation (future)

Total points won	Order		
142点	1	京セラ	Kyocera
82	2	日本電気	Nippon Electric
69	3	富士通	Fujitsu
45	4	日立製作所	Hitachi, Ltd
44	5	電電公社	Nippon Telegram and Telephone
39	6	協和醗酵	Kyowa Hakko
37	7	ファナック	Fanuc, Ltd
33	8	日本IBM	Nippon IBM
32	9	野村証券	Nomura Securities
28	10	トヨタ自動車	Toyota Motors
26	11	松下電産	Matsushita Electric Industries
26	11	東レ	Toray Industries
24	13	シャープ	Sharp
24	13	住友電工	Sumitomo Electric Industries
22	15	サントリー	Suntory
21	16	ソニー	Sony
20	17	本田技研	Honda Motors
19	18	武田薬品	Takeda Chemical Industries
18	19	キヤノン	Canon
16	20	旭化成	Asahi Chemical Industries
15	21	西武百貨店	Seibu Department Stores
13	22	三菱化成	Mitsubishi Chemical Industries
12	23	TDK	
12	23	セブン-イレブン	Seven Eleven
10	25	富士フイルム	Fuji Photo Film
10	25	日立マクセル	Hitachi Maxell
10	25	松下通信工業	Matsushita Communications Industrial
9	28	ダイエー	Daiei
9	28	味の素	Ajinomoto
9	28	西武鉄道	Seibu Railway
9	28	日本警備保障	Nippon Keibi Hosho
8	32	富士ゼロックス	Fuji Xerox
8	32	新日本製鉄	Nippon Motors
8	32	来島どっく	Kurishima Dock
8	32	呉羽化学	Kureha Chemical Industries
8	32	三菱重工業	Mitsubishi Heavy Industries
7	37	立石電機	Omron Tateisi Electronics
7	37	ミネベア	Minebea Co
7	37	オリエントファイナンス	Orient Finance Co
7	37	オリエント・リース	Orient Leasing Co
6	41	住友銀行	Sumitomo Bank
6	41	旭硝子	Asahi Glass
6	41	日産自動車	Nissan Motors
6	41	東京芝浦電気	Toshiba Corporation
6	41	服部セイコー	Hattori Seiko
6	41	任天堂	Nintendo Playing Card
5	47	日本電装	Nippon Denso
5	47	アシックス	Asics Corp
5	47	麒麟麦酒	Kirin Brewery
4	50	西友	Seiyu Stores, Ltd

Table 8. Much Observed Giant Enterprises--Honda, Hitachi, Sharp, Nippon Electric, Nippon Telegraph and Telephone (Enterprises presently under observation)



Note: As to the enterprises ranked below 10th, only those with special traits and ranked within 30th were chosen.

Key: [Table 8]

1. The size of the rated enterprise (number of employees)
2. Enterprises under evaluation
3. Kyocera
4. Nippon Electric
5. Fujitsu
6. Toyota
7. Seibu Department Stores
8. Hitachi, Ltd
9. Homura Securities
10. Sharp
11. Suntory
12. Fanuc, Ltd
13. Honda Motors
14. TDK
15. Sony
16. Canon
17. Yamato Transport
18. Nippon Telegraph and Telephone
19. Person
20. Above 10,000 persons
21. Concentrated observation by medium and large size enterprises
22. Level of observation by giant enterprises
23. Year of establishment of the rated enterprises
24. Meiji period
25. Taisho period
26. Up to 1944
27. Showa 20s (1945-1955)
28. Showa 30s (1955-1965)
29. Showa 40s (1965-1975)
30. Since 1975
31. Overwhelming attention of the enterprises established in the postwar period (popular even among the enterprises established during the Meiji period)
32. Attract the popularity of the enterprises established in the Showa 40s (1965-1975)
33. Attention of the enterprises established in the postwar period.
34. Attention of the enterprises established in the Showa 30s (1955-1965)
35. Attention of the enterprises established in the Showa 20s (1945-1955)
36. Attention of the enterprises established during the Showa 20s and 30s (1945-1965)
37. Attention of the enterprises established in the Showa 20s (1945-1955)
38. Attention of the enterprises established during the Meiji period

Table 9. The Five Best Enterprises Based on Industry-by-Industry All-around Ratings

Rank	Rating by the financial institution	Chemical and pharmaceutical	Electric	Automobile and transportational instruments	Circulation
1	Sumitomo Bank	Toyota Motors and Hitachi, Ltd	Matsushita Electric Industries	Toyota Motors	Toyota Motors
2	Toyota Motors		Toyota Motors and Hitachi, Ltd	Matsushita Electric Industries	Hitachi, Ltd
3	Matsushita Electric Industries and Nomura Securities	Toray Industries and Fuji Photo Film		Hitachi, Ltd	Matsushita Electric Industries
4			Kyocera, Suntory and Sharp	Kyocera	Seibu Department Store
5	Hitachi, Ltd	Kyocera		Honda Motors, Fujitsu and Sony	Suntory

Table 10. The 10 Most Respected Executives

	11 社長生年						12 企業規模（従業員数）					
	13 明治	14 大正	15 昭和元～9年	10～19	16 20年以降		17 30人未満	31～99	100～499	500～999	1000～2999	3000～4999
1	19	71	29	18	3	19 (第1位) 松下幸之助 140票	7	7	46	36	24	10
2	1	41	9	3	1	20 (第2位) 土光敏夫 55	2	0	20	9	11	8
3	1	8	5	2	0	(第3位) 21 本田宗一郎 16	0	1	9	2	3	0
4	0	9	1	1	0	(第4位) 22 磯田一郎 11	0	0	1	3	5	0
5	0	6	2	0	0	(第5位) 23 小林宏治 8	0	0	2	3	1	1
6	1	5	2	0	0	(第6位) 24 坪内寿夫 8	1	2	2	2	1	0
7	0	4	1	2	0	(第7位) 25 伊藤雅俊 7	0	0	3	1	3	0
8	0	1	2	3	0	(第8位) 26 盛田昭夫 6	0	1	2	2	1	0
9	1	5	0	0	0	(第9位) 27 櫻田武 6	0	0	2	2	1	0
10	0	4	1	0	0	(第10位) 20 堤清二 5	0	0	1	0	1	2

Key: [Table 10]

1. Matsushita Konosuke, counselor for Matsushita Electric Industries Co, Ltd
   "God of Management Philosophy" "Coincidence of Theory and Practice"
2. Doko Toshio, honorary president of Keidanren
   "Firm, Sound and Impartial" "Words and Deeds Correspond"
3. Honda Shoichiro, supreme advisor to Honda Motors
   "Vigorously Research-minded" "His Moves Are Refreshing"
4. Isoda Ichiro, president of the Sumitomo Bank
   "With decisiveness and leadership, he weathered difficulties"
5. Kobayashi Koji, president of Nippon Electric Co, Ltd
   "Superior Foresight and Leadership"
6. Tsubouchi Hisao, president of Kurushima Dock
   "Puts through what he believes is right" "Ability demonstrated in rebuilding the company"
7. Ito Masatoshi, president of Ito Yoka Do, Ltd
   "Modesty, Foresight and Decisiveness" "Faithful to the Basics"
8. Morida Akio, president of the Sony Corporation
   "Broad Vision, Cosmopolitan" "Cultivates Men of Ability"
9. Sakurada Takeshi, honorary president of Nikkeiren
   "Firm Management Ideals" "Sound Management"
10. Toyota Eiji, chairman of the board, the Toyota Motor Co
    "Execution of Rational Management" "Man of Vision"
11. Year of birth of company presidents
12. Size of enterprises (number of employees)
13. Meiji
14. Taisho
15. 1925-1934
16. 1945 and after
17. Under 30 persons
18. Above 10,000 persons
19. First rank, Matsushita Konosuke, 140 votes
20. Second rank, Doko Tashio, 55 votes
21. Third rank, Honda Shoichiro, 16 votes
22. Fourth rank, Isoda Ichiro, 11 votes
23. Fifth rank, Kobayashi Koji, 8 votes
24. Sixth rank, Tsubouchi Hisao, 8 votes
25. Seventh rank, Ito Masatoshi, 7 votes
26. Eighth rank, Morida Akio, 6 votes
27. Ninth rank, Sakurada Takeshi, 6 votes
28. Tenth rank, Toyota Eiji, 5 votes

QUALITY CONTROL IN MOTOR VEHICLE PRODUCTION DISCUSSED

Tokyo JIDOSHA GIJUTSU in Japanese Jul 83 pp 750-757

[Article by Genichi Taguchi]

[Text] I. Manufacturing and Quality Control Activities

When support sectors are excluded, manufacturing and quality control are comprised of the following six activities:

(1) Planning the article to be manufactured: activities that determine the performance, price, design and life of the article to be manufactured.

(2) Designing the article to be manufactured: drawing up the specifications of the article whose performance criterion was determined under planning at minimum cost.

(3) Establishing the pace of production: activity to determine the production rate of the article whose use and diagrams were given in the specifications.

(4) Production: daily production routine.

(5) Market development: activity that determines the means of informing potential consumers of a new or improved article.

(6) Sales: regular, normal sales activity.

Where does quality control fit into these various sectors? In Japan, quality control appears to be aimed at improving the quality of all phases of the functions involved; we will address ourselves to studying the possibility of reducing the number of functional inconsistencies. This is aimed at preventing malfunctions during the design life of a manufactured article. Consequently, a reduction in the function inconsistent measure itself becomes a quality control activity of functional quality.

In order to reduce functional deficiencies, it is necessary to apply countermeasures to the original cause of the deficiency. These causes can be roughly divided into the following three categories:

(1) Outside influence: environmental conditions which cause functional disorders.

(2) Deterioration: deterioration of the manufactured article which leads to functional deficiencies.

(3) Intra-article malfunctions: the development of incompatibilities in the functions of component parts.

To manufacture an article with functional goals, manuals and charts are drawn up. When incompatibilities arise between component parts which have been fabricated in accordance with specifications contained in the manual, there are instances of one item achieving the targeted function while another does not, causing a malfunction. When an article fabricated under given specifications breaks down after extended use, it is a malfunction due to deterioration, and this is an internal problem. If an article fabricated according to specifications functions well under normal conditions but does not function satisfactorily in high temperatures, high humidity, or when the source of electric power fluctuates even 20 percent, it is a malfunction due to external conditions.

Consequently, when it is said that an item has good functional quality, this means that disorders within the article are minimal and it functions normally during its designed lifetime, under a broad interpretation of those terms, and that external conditions such as temperature, moisture, and variation in electrical source pressure have minimal adverse effect. Moreover, if the component parts show little deterioration even after long usage and if the wear from friction causes little incompatibility between the component parts, it can be said that the article has high functional quality. Quality in terms of targeted function, then, can be measured by the extent of deviation from the targeted standard (either the nominal value or the ideal value as predetermined by the usage specification).

Activities to deal with malfunctions include the following "maker activities" listed: (2) designing the article, (3) production pace, (4) production and (6) sales. (2) and (3) are considered offline quality control while (4) and (6) are classed as online quality control. In the United States, malfunctions due to environmental conditions and deterioration are classed as reliability related problems. In fact, of the malfunctions, the article designers are responsible for dealing with environmental and deterioration related problems, which cannot be handled by the designers of production pace nor the outline sectors (see Table 1).

"Countermeasures" as used in Table 1 will be explained in subsequent paragraphs.

Table 1. Coping With Functional Quality

	Sector	Countermeasures	Environmental interference	Deterioration	Intra-article malfunctions
Off-line Quality Control	R&D	(1) System development	P	P	P
		(2) Parameter designs	P	P	P
		(3) Margin design	NA	P	P
	Production techniques	(1) System design	I	I	P
		(2) Parameter design	I	I	P
		(3) Margin	I	I	P
Online Quality Control	Manufacturing	(1) Work progress and adjustments	I	I	P
		(2) Estimates and calibrations	I	I	P
		(3) Measurements and dispositions	I	I	P
	Administration	(1) After service	I	I	I

(Symbols: P, possible; NA, possible but not advisable; I, impossible)

II. Designing the Article and Quality Controls

Designing includes the following categories:

(1) Total system designing
(2) Subsystem designing
(3) Unit designing
(4) Development of parts and components
(5) Development of raw materials

In each of the above, there are three design steps:

(1) System development (also called primary designing): functional designing--specialized techniques are central to this;

(2) Parameter designing (also called secondary designing): methods of reducing costs and improving quality--programmed experimentation can be used to good effect;

(3) Allowable margins designing (also called tertiary designing): method of pinpointing cause but at increased cost--possible application of programmed experimentation by maker.

1. System Designing (Primary Designing; Functional Designing)

As an example let us take the electric power source circuit which fires the spark: What kind of circuits should be studied using specialized techniques to best convert the battery's direct current to alternating current? In the case of raw materials, it may be a search for a reactive pace that will lead to the production pace most suited to produce the targeted article. It is the step in which the optimal work pace is estimated.

Automatic control systems are also included in this. For example, assuming that the targeted sparking voltage is 20 kV, the output voltage is measured moment by moment, and if there is a difference from 20 kV, a parametric device in the circuit such as a variable resistor component is made to automatically adjust the electrical pressure to zero difference from 20 kV. However, it is not only very difficult to prevent deterioration or to provide variation control in such automatic control systems, but there is additional cost in building in such a device. Consequently, such a solution does not contribute to a good, stable circuit design without an increase in cost.

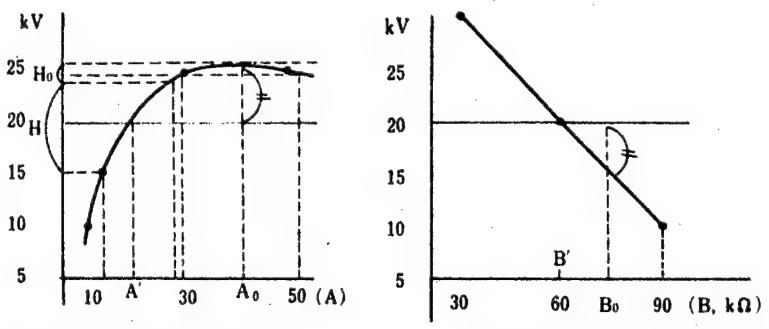
Although system designing is very important, since there are innumerable systems capable of accomplishing the same function, not all systems can possibly be researched. Therefore, experience and estimations must play a role in selecting one or maybe even two or three systems. There is no good way of selecting the optimal system design. Since using a new and unique system on which there is no reference material can be protected by a patent, coming up with a new system is very desirable.

2. Parameter Designing (Secondary Designing)

On reaching a decision on a system design, the next step is to determine the optimal standards for the parametric values of components compatible to the system. In the past, research in this area has been somewhat undisciplined, particularly in developing countries. In those countries the practice has been for the researcher to peruse papers, impart technology and with his particular abilities, to design and test the electric firing system which he thinks best. Then a battery as an electric power source is introduced into the circuit and if the resulting electrical voltage output is 20 kV, the effort is deemed successful; if the 20 kV target is missed, the parametric values of the components are adjusted in order to produce the targeted output. The process can be likened to showing a dye worker a sample to match, and he, with all his knowledge, tries out various colorings and shades and makes test dyeings. If it turns out satisfactorily, the project is deemed a success, but if there are discrepancies between it and the sample in color or shade, color ingredients are added to bring about a satisfactory product. Thus, if the targeted object has three special characteristics, a satisfactory result can be obtained by determining the three major factors which establish those characteristics, and therefore experiments need be conducted on just three factors.

However, discrepancies from targeted values (there can be more than one special characteristic, but since the basic procedures are identical and are only multiplied by the number of special characteristics, we are considering the case of there being only one in the interest of simplifying the explanation) are corrected at the worksite. These are referred to as modifications or calibrations, never as designs.

The designing carried out by technicians in developing countries is really not designing but modifying, as described above, and is no different from the educated hit-or-miss process the dyer undertakes at his workplace. Let us take a hypothetical case in which the parameter of a circuit system is a transistor, $h_{FE}A$, and resistor component B produces an effective electrical output as shown in Figure 1.



(a) $h_{FE}A$ and Firing Voltage

(b) Resistance B and Firing Voltage

Figure 1. Relation Between Firing Voltage and Parameter h_{FE} and Resistance in Design

In Figure 1 (a), the transistor h_{FE} in the circuit has been given a hypothetical value of 10, at which an electrical output of only 10 kV is obtained. When h_{FE} is at 10, 30, and 50, the firing voltages change, as shown in Figure 1 (a); the targeted voltage of 20 kV is obtained at h_{FE} at A' = 20. As a quality control factor, this is not satisfactory. To design a low-cost, high-reliability firing circuit, a cheap transistor must be used. Imprecise early characteristics and a high rate of deterioration strongly affected by environmental changes are inherent in the h_{FE} or cheap transistors. If a third-rate transistor is used, the h_{FE} values vary by ±30 percent of the indicated value: Figure 1 (a) shows that if A' = 20 is selected, the range of electrical firing could occur anywhere in the 8 kV output span between 16 kV and 24 kV. If the source battery's power is reduced to the point that it cannot deliver enough for even the minimum point of the 8 kV span, there is no spark. If $A_0 = 40$ is hypothetically chosen as h_{FE}, even with a peripheral ±30 percent variance, the variation in the output is 24 - 26 kV, a variation of only 2 kV, which equates to one-fourth of the variation at A'. As will be indicated later, since loss due to variation increases at the rate of the second power, the quality standard of A_0 is 16 times better than that of A'. Admittedly, the firing voltage will be increased by about 5 kV, but this can be accomplished, as shown in the Figure 1 (b) resistor, with a component directly affecting the output power.

With regard to resistor B, the B' = 60 kΩ would have to be replaced by B_0 = 75 kΩ. As in the parameter for B, allowable variations cannot be reduced--a prerequisite in an item which has a direct line affect on the output--by standard selection. Therefore, it is essential to use a high-grade component which allows only a minimum of variation and has a low deterioration rate. It should be noted that no more than one parameter is required for making adjustments. In experiment programming, this parameter is called the "signal factor."

As with parameter h_{FE}, where the influence on output voltage is nonlinear, the selection of A_0, which is at the peak, makes possible the automatic reduction of fluctuation effects. It is a highly rated designing tactic that contributes to lowering the cost and improving the quality. This method has traditionally been called "utilization of nonlinear form." However, by selecting A_0 for A, which would reduce its own deficiencies, the required parametric changes would produce multiple deficiencies in other components with intolerable results. It is essential that designing take into consideration such eventualities as well as negative effects that environment and other variables may have on the parameters. It is at this point that direct conversion tables and cumulative calculation methods which are the backbone of programmed experimentation should be utilized.

See referenced paper (1) for details.

The secondary designing phase is the most important step, wherein the designing of articles (or production procedures) requiring a high degree of stability and reliability is involved. This involves a technique that utilizes nonlinear characteristics as in factor A. It is the step in which ways must be found to compositely reduce not only internal malfunctions but the source of all irregularities while maintaining steady electrical output power. It is in this step that ways are to be found with which cheap materials, cheap parts and cheap components that are prone to produce wide fluctuations and that deteriorate easily may be used to produce articles (or production procedures) of broad-based high reliability. In design research, this is a very critical phase.

It is here that the target of programmed experimentations is found. The process of selecting from the innumerable factors available that can be assembled and coordinated most effectively is, in fact, the subconscious application of the principles of nonlinear characteristics. With that goal, consideration is given to the special characteristics of the target, and determining whether pertinent factors are being properly treated becomes very important in applying programmed experimentation. In the developing countries, where inconsistency in the standards of materials and parts is the highest, the above is the most important factor in quality control. For that reason, the demand for technical assistance in achieving a highly stable secondary design process is far higher from developing countries than from advanced countries. When an article is designed which has unwavering stability even in the face of some environmental changes and some fluctuations in the operation of the parts or some deterioration, then even if there is some wavering in the components, the article will function satisfactorily, enabling inexpensive designing. Since

all three potential sources of quality deficiencies can be countered as described above, it must be concluded that it is the ideal countermeasure.

Secondary designing is at the heart of programmed experimentation and is dependent on optimally coordinated assembling of parameters. The reason that India, which is well aware of usable reference materials and which operates jointly with some of the world's biggest enterprises, still produces items of substandard quality is due to its swallowing whole the parameters specified in the manuals without making any modifications.

3. Designing Allowable Margins (Tertiary Designing)

Having decided on the system and determined the optimal value of the various factors which are vital to that system, the allowable margins due to the fluctuations from the norm of the various factors involved must be determined. To determine a standard for the factors involved, the range of fluctuations of not only those factors inherent in the system but deviations due to environmental conditions must be taken into consideration. There are put into context and treated as deficiencies to determine the effect they have on output characteristics. In components in which this negative effect is large, consideration must be given--including the cost factor--to establish an allowable variable from the norm. This method differs from the second-phase designing in that narrowing the margin of error of a component's function is an invitation to increase the cost. Therefore quality control problems should be solved in the secondary designing stage wherever possible. However, when the problem cannot be completely solved in the second designing step, when the total solution is beyond the bounds of the secondary designing phase, the third designing phase must be made responsible for reducing the factors which have large negative effects on the function by taking steps to narrow such deficiencies to an acceptable margin. In this case, it is important that the value of loss due to the deficiency be clearly established.

As an example of calculating that value, the firing voltage hypothesis will be used. What the kilovoltage of electrical pressure should be at the instant of firing is a problem in the parameter designing of the automobile's total system. Although 20 kV has been traditionally accepted as the norm, it is possible that 3 kV is optimal. If 3 kV were optimal, the cost of the entire system, including the cost of the power source, would be lowered. The problems inherent in corona discharges would also be greatly reduced. Regrettably, such design studies have not been made in Japan; it is said that the 20 kV standard was imported from the United States without any questions being asked.

But in establishing a design parameter, whether that is the optimal value or not must be clearly established. If 20 kV is the value established, the engine gasoline volume sparkplug and other components must be designed to function most compatibly with an electrical discharge pressure of 20 kV. Thus, if 20 kV is selected as the firing voltage, it has to be 20 kV, and if there are broad deviations from that figure, there will be trouble. Let us assign L(y) as the loss factor involved here.

The loss factor L(y) is defined as follows: Originally the output voltage is y, but it becomes L(y) which is an average over its designed lifetime, T years, because of loss due to various conditions encountered in usage; to maintain a firing voltage target of m (= 20 kilovolts) with L(y) as the loss factor, the tailoring of m is

$$L(y) = L\ (m+y-m) = L(m) + \frac{L'(m)}{1!}\ (y-m) + \frac{L''(m)}{2!}\ (y-m)^2 + \ldots \qquad (1)$$

When the firing voltage "y" is at "m," loss is at a minimum, so the loss factor "L'(m)" is zero. So $(y-m)^2$ is the major factor in the loss due to deterioration of "y" from "m." Eliminating the course of degradation, we have

$$L(y) \doteqdot k\ (y-m)^2 \qquad (2)$$

The rate factor "b" is derived as follows: How far down does firing voltage have to fall before sparking ceases to occur, and how much is A_0--decrease cost to the consumer--at that point? Assuming that sparking ceases when voltage is dropped to 8 kV and the cost to the consumer (cost of repairing and loss from stoppage of operation until repairs are completed) is 30,000 yen with the loss factor, (y-m) in (2) above, the loss would be 30,000 yen for L(y) at (-12) kilovolts

$$30{,}000 = k(-12)^2$$

or

$$k = \frac{30{,}000}{(-12)^2} = 208.3 \quad (\text{yen/kilovolt}^2) \qquad (3)$$

Admittedly, there will be a loss due to the corona discharge effect if the output voltage rises too much, but in the interest of simplification, it is assumed that the allowable margins both up or down are the same. In that event the loss factor is:

$$L = 208.3\ (y-20)^2 \qquad (4)$$

Even with an allowable fluctuation to the consumer of 20 ± 12 kV, the variations will necessitate major changes in the diagrammed specifications because the value of resistance of the resistors will have to be changed during the production process to maintain the targeted values. However, such adjustments can be made easily. Assuming the cost of adjustment, A, is 160 yen, then A = 160 yen must be substituted in the left side of formula (2) and then we have

$$y = 20 \pm \sqrt{\frac{160}{208.3}} = 20 \pm 0.9 \ (\text{kV}) \qquad (5)$$

This means that although the allowable range to the consumer (at point LD 50) is ±12 kV in the plant, everything that falls outside the range of 20 ±0.9 kV will fail and will require redoing. Should an item be shipped which has an output voltage of 18 kV, the shipper may save an adjustment expense of 160 yen, but the consumer will be faced with a loss of

$$208.3\ (18-20)^2 = 833.2 \ (\text{yen}) \qquad (6)$$

This is worse than out and out robbery!

The actual allowable margin to the consumer (the value at which the item becomes inoperable) is $\pm\Delta_0$, at which time the loss to the consumer is A_0 yen; if it is assumed that the loss incurred if the item were deemed unacceptable at the factory is A yen, the diagrammed allowable margin Δ would be given by the following:

$$\Delta = \sqrt{\frac{A}{A_0}}\ \Delta_0 \tag{7}$$

The allowable difference Δ in the special characteristics of the component parts, assuming that the effect on the targeted characteristic when a change took place in the unit volume is "B," is:

$$\Delta = \sqrt{\frac{A}{A_0}}\ \times \frac{\Delta_0}{B} \tag{8}$$

At this point, Δ_0, A_0 with allowable difference from the targeted special characteristic Δ_0, problems in the targeted characteristic would cause a loss of A_0 yen. For a detailed explanation, see referenced paper (1).

The quality problem to be solved in fabrication designing is to design articles which perform satisfactorily under broadbased usage conditions while using cheap parts and materials through, in order: system development, parameter designing and designing allowable variations.

III. Designing Production Procedures and Quality Controls

There are also three steps in designing production procedures, as follows:

(1) System designing
(2) Parameter designing
(3) Designing allowable variations

Designing parameters defines the logical standards for the processing parameter. There is a story describing an incident which occurred more than 20 years ago. A certain plant that was engaged in mass-producing crankshafts was beset with defectively shaped products. At that time, the pinpointing of whether the cause of the trouble lay in defective raw materials or deficiencies in the fabricating machinery or due to lack of experience in the labor force should have been placed within the realm of (3)--designing allowable variations. Designing such allowable margins logically should come after parameter designing. The overall deficiency was reduced to one-tenth without pinpointing the basic deficiency but by making adjustments and alterations in the parameters of finishing procedures, the finishing up pace, the type of tools, the usage of tools, etc. Since designing production procedures is basically the same as designing the fabrication of items, further explanations will be omitted.

IV. Outline of Quality Control, Fabricating Sector's Quality Control

Having completed fabrication designing, production process system designing, parameter designing and after accomplishing allowable variation designing, production is entered into. The real-time quality control activity that is carried out at the production site on a regular daily basis is called "online quality control." There are three online quality control measures.

1. Diagnosis and Adjustments to Work Pace

This phase, usually called work pace control, is that pace of work which has been diagnosed as most conducive to the proper rate of continuous production. If a situation which is considered an irregularity arises, it is this control which should ferret out the cause and determine the way to return the production process to normality. When there is a prognostication of a breakdown, adjusting the production pace as a preventive measure is also a function of this control.

2. Prognostication and Corrections

These are called checks. When a certain type of control is desired involving measure characteristics or work pace conditions, measurements are taken at equal intervals; when the value obtained by these measurements is used as is to continue production, the special characteristic value (average value) of the item to be produced is predicted. If there is a discrepancy between this predicted value and the targeted value, corrective actions must be taken by moving the standard level of the signal factor, which is the factor to be used to make corrections, to lessen the discrepancy between the two values. It is of great importance that a logical system be designed to accomplish this, and this is called the "feedback control" method.

3. Measurement and Disposition

This is also called inspection. Each item is subjected to measurements, and if they are outside acceptable limits, corrections are made or the item is disposed of. Category 3 differs in nature from categories 1 and 2 in that the latter are related to the pace of work, while category 3 pertains only to the article produced.

In controlling automatic checks and robots, it is necessary to check the sensors. Let us give consideration to sensors, or to measuring system controls. In the method described above, measurement and disposition of the finished articles is accomplished by measuring the articles to determine whether they meet the requirements. When such a step is accomplished by a measuring device, the concept is to determine whether the device gets passing marks, which is not the same as making needed adjustments to a measuring device at the worksite. What is involved here is revision of the parametric discrepancies, which should fall into the bailiwick of prognostication and correction, or under category 2 above.

On the other hand, if the measuring device's deficiencies grow gradually or suddenly occur to a point that a decision is required as to whether to make repairs or replace it with a new device, it falls into the realm of category 1 above, or under "diagnosis and adjustment" (of the measuring device). Frequently, it is not easy to decide whether the device should be adjusted, undergo repairs or be replaced. In general, if at the point of diagnosis the measuring device shows a variation greater than that deemed allowable, the measuring device is subjected to repair or replacement.

If the malfunctioning of a measuring device is beyond mere minor retuning, and corrective steps (defined as a major repair or disposal) are required, the decisionmaking (in online quality control this is called diagnostics) is not in the realm of corrections but becomes heavily reliant on diagnostic adjustment of the system design.

It should be emphasized here that as is stipulated in the control manual, even when the source of the deficiency is found, there is no basic countermeasure (in online quality control) which guarantees that the same thing will not be repeated. It only deals with the deficiency as a normal daily routine. The writer firmly believes that /the design of a correct online quality control system should include a control discipline which would prevent the system from getting out of control./ [in boldface] As to details of objective individual examples, refer to referenced paper (2).

The concept of an online quality control method is discussed next.

1. Effective Example of Diagnostic Adjustments and Calculation Formula

In about 1970, the work pace of I Company's truck engine cylinder production was comprised of about 28 steps. It was essential to know whether the work in each of those steps was being accomplished correctly, and quality control checks for each step became essential. We will leave the details to referenced paper (2), but we will use the reamer drilling step as an example to explain the procedure. During this step, the reamer drills about 10 holes simultaneously. Should even one of these holes develop a mere 10 micrometer bend, the whole cylinder block would have to be scrapped. The loss, A, at that point would be 8,000 yen. The cost of inspecting for acceptability of the drilling, B, is 400 yen and these inspections are made at 30 unit intervals. Calling this interval "n," the current "n" is 30. During the past 6 months, 18,000 items were produced and there were 7 breakdowns.

Therefore, if "$\bar{u}$" is the interval between breakdowns, it

$$= \frac{18,000}{7} \fallingdotseq 2,570 \text{ (items)} \tag{9}$$

If a bend in the drilled hole is discovered, work is halted, the reamer is replaced, a check is made to see if the drilling in the previous item was satisfactory, and if positive, production is resumed. The cost incurred in such a work stoppage, the tool expenses involved in replacing such work tools, and the labor costs altogether are called adjustment costs. The adjustment cost "C" in this particular instance was 20,000 yen.

In work pace tuning under online quality controls, the parameters which characterize the three main functions of the system--work pace, diagnostic method, adjustment method--are subject to the above defined A, B, C, $\bar{u}$, and ℓ and to the interval between inspections, n, which ties the main functions together. With n as the interval between inspections, quality control cost L, from the theory derived from work adjustment, is given in the formula below. For an explanation of the formulas, see chapter 3 of referenced paper (2).

$$L = \frac{B}{n} + \frac{n+1}{2} \cdot \frac{A}{\bar{u}} + \frac{C}{\bar{u}} + \frac{\ell A}{\bar{u}} \tag{10}$$

In this instance, n = 30, A = 8,000 yen, B = 400 yen, C = 20,000 yen, $\bar{u}$ = 2,570 items, ℓ = 1 item

so
$$L = \frac{400}{30} + \frac{30+1}{2} \cdot \frac{8,000}{2,570} + \frac{20,000}{2,570} + \frac{1 \times 8,000}{2,570}$$

$$= 13.3 + 48.2 + 7.8 + 3.1$$

$$= 72.4 \text{ (yen)} \tag{11}$$

This is the cost of quality control per item; at an annual production rate of 36,000 items, or 72.4 yen x 36,000, it would be 2.61 million yen. The extension of quality control is aimed at reducing the cost of quality control L, above. There are two approaches to accomplish this: the individual item technique method and the control technique method. Attempting to establish a work pace which will reduce breakdowns, thinking about simplifying inspection procedures, considering methods of reducing the cost of making adjustments--all these are research projects to be pursued by individual plants, so they are individual item technique countermeasures.

In contrast, there is a way to lower quality control costs without altering the current work pace, current inspection methods or current adjustment making methods. This is called control technique, a very soft technique which can be made applicable to every kind of work pace. Just two such techniques will be introduced here. One is the manner in which the /interval between inspections/, [in boldface] n, is determined and the other is the introduction of /preventive integrity by periodic exchange./ [in boldface] The optimal interval between inspections n may be obtained by the following formula:

$$n = \sqrt{\frac{2(\bar{u} + \ell)B}{A - C/\bar{u}}} \tag{12}$$

For example, in the drilling step referred to above

$$n = \sqrt{\frac{2(2,570 + 1) \times 400}{8,000 - 20,000/2,570}} \fallingdotseq 16 \text{ (items)} \tag{13}$$

If the interval between inspections n is 16, quality control cost L would be

$$L = \frac{400}{16} + \frac{16+1}{2} \cdot \frac{8,000}{2,570} + \frac{20,000}{2,570} + \frac{1 \times 8,000}{2,570}$$

$$= 62.4 \text{ (yen)} \tag{14}$$

This is a rationalization of 72.4 - 62.4 = 10.0 yen per item and amounts to 360,000 yen a year. In this case, changing the value of n even by 20 percent brings about very little change in the value of L. For example, with n = 20:

$$L = \frac{400}{20} + \frac{21}{2} \cdot \frac{8,000}{2,570} + \frac{20,000}{2,570} + \frac{8,000}{2,570}$$

$$= 63.6 \text{ (yen)} \qquad (15)$$

which produces a difference of only 1.2 yen from (14). Therefore, errors of even 30 percent in the system parameters for A, B, C, $\bar{u}$, and ℓ can be tolerated, and even after selecting an optimal interval between inspections, n, by estimation, its value can subsequently be changed by even some 20 percent without harm.

Next, let us introduce preventive integrity to rationalize quality control.

Integrity through preventive measures comes in two forms: periodic inspection and periodic replacement. In the latter, those parts or components which are vulnerable to malfunctioning are replaced with new ones periodically without inspection. For example, assuming that a certain working part's average life has been found to be 3,000, when it has been used 2,000 times it is replaced by a new one, regardless of whether it is still functioning normally. Under the periodic inspection method, inspections are conducted at a specified interval, n, and if although the inspected item is still functioning it is estimated that it will not last until the next regular inspection, it is replaced. We will discuss only the periodic replacement method here.

In the case of drilling holes with the reamer referred to earlier, most of the problems are due to deterioration of the tool, so it is decided that the drills will be replaced at use intervals, $\bar{u}'$, of 1,500--long before the average interval between breakdowns, $\bar{u}$, of 2,570. The cost at that time is C', and it is assumed that C', is approximately the same as C at 18,000 yen. We will assume that the breakdown rate before 1,500 uses is 0.02. The 2 percent breakdown rate includes crooked drill holes due to pinholes in the cylinder block as well as due to other causes. So the interval between breakdowns, $\bar{u}$, is 75,000 as follows:

$$\bar{u} = \frac{1,500}{0.02} = 75,000 \text{ (items)} \qquad (16)$$

Therefore the new optimal inspection interval is

$$n = \sqrt{\frac{2 \times (75,000 + 1) \times 400}{8,000 - 20,000/75,000}} \fallingdotseq 87 \fallingdotseq 100 \text{ (items)} \qquad (17)$$

The loss at this time is

$$L = \text{(preventive integrity cost)} + \text{(diagnostic adjustment cost)}$$

$$= \frac{C'}{u'} + \left(\frac{B}{n} + \frac{n+1}{2} \cdot \frac{A}{\bar{u}} + \frac{C}{\bar{u}} + \frac{\ell A}{\bar{u}} \right)$$

$$= \frac{18,000}{1,500} + \left(\frac{400}{100} + \frac{101}{2} \times \frac{8,000}{75,000} + \frac{20,000}{75,000} + \frac{1 \times 8,000}{75,000} \right)$$

$$= 12.0 + 9.8$$

$$= 21.8 \text{ (yen)} \qquad (18)$$

Therefore, in comparison with achieving no preventive integrity, there is a saving per item of 63.6 - 21.8 or 41.8 yen. This is equivalent to 1.5 million yen over a year. If there could be such a saving at each of the 28 steps involved in fabricating a cylinder block, there would be a saving of 42 million yen per annum.

With only this quality control measure, in cost the improvement is equivalent to increasing the average interval between breakdowns by 6.3 times without any increase in cost. In other words, the preventive integrity method is a unique technique of extending the interval between breakdowns by 6.3 times in profits.

2. Prognostication and Correction; Theory of System and Example of Calculation

If there is a value attached to the special characteristic and a signal factor which will correct discrepancies between it and the targeted value, that signal factor can be used as a control for the measured value. For example, the signal factor which controls the thickness of steel plate is the pressure rate of the press, and that which controls the temperature is the flow rate of the fuel.

In order to control volume measurements, the following three problems have to be solved:

(1) Selection of optimal interval between measurements

(2) Using the measured value, estimation of the average of the characteristic values to the point of the next measurement reading

(3) Determination of the optimal correction count to reconcile the difference between the targeted value and the estimated value.

The parameters are as follows:

A: loss caused by production of unacceptable item
Δ: allowable variation
B: cost of making measurement
C: cost of changing special characteristic value to targeted value
σ_0^2: fractional amount of drift per unit
n : interval between measurements

Assuming the corrective action has to be taken once for every three times measurements are made, the optimal interval between measurements n would be:

$$n = \sqrt{\frac{2\ (B+C/3)}{A}} \times \Delta \tag{19}$$

and the total loss factor L and optimal corrective limitations at that time are:

$$L = \frac{B}{n} + \frac{C}{3n} + \frac{A}{\Delta^2} \times \frac{n\ \sigma_0^2}{2} \tag{20}$$

$$\Delta_0 = \sqrt{n\sigma_0^2} \tag{21}$$

When the parameter is a process parameter, the effect b on the targeted characteristic when the unit basis of the process parameter is changed requires only that Δ be replaced by Δ/b. The example of the calculation process is omitted.

3. Measurement and Disposition (Inspection)

In contrast to diagnostic adjustments, and prognostication and correction, which were actions pertaining to work pace, this action, measurement and disposition, is central to the fabricated article and its disposition. Therefore, the measurements in this instance are directed at the article itself and are compared with established specifications to determine whether it is acceptable, and if unacceptable, whether it should be corrected or discarded. A simple example of calculation will be used.

Let us assume that the allowable toxic gases in running an automobile in a certain mode are 2.4 kilograms or less. The cost of making the inspection is 800 yen, and those items which exceed the allowable limits are repaired and then shipped out. When that cost is added to the reinspection cost it comes to 12,000 yen. When 15 vehicles were given toxicity volume (g) tests, the result was as follows: 1.6, 1.2, 1.5, 2.1, 2.8, 1.7, 2.0, 1.8, 1.4, 1.0, 1.5, 2.5, 2.2, 1.4, 1.8.

From the above data (in a plant, data should be collected on at least 50 automobiles) calculations are made when no inspections are made and when all cars are inspected to determine profit or loss.

When no inspection was made:

$$L_0 = \frac{\text{Loss due to exceeding regulation limits}}{(\text{allowable difference})^2} \times \sigma^2 \qquad (21)$$

[as published]

$$\sigma^2 = \frac{1}{15} \left(1.6^2 + 1.2^2 + \cdots + 1.8^2\right)$$

$$= 3.34 \qquad (22)$$

Therefore,

$$L_0 = \frac{12{,}000}{2.4^2} \times 3.34 = 6{,}958 \text{ (yen)} \qquad (23)$$

When all the items have been inspected and the defective ones fixed, assuming the square of the average of the ones which needed fixing is approximately the same as the square of the average of those which passed inspection,

L = inspection cost + (loss due to discovery of defective items) x rate of defectiveness + loss of items which were within the required specifications

$$= 800 + 12{,}000 \times \frac{2}{15} + \frac{12{,}000}{2.4^2} \times \frac{1}{13} \left(1.6^2 + 1.2^2 + \cdots + 1.8^2\right)$$

$$= 800 + 1{,}600 + 2{,}083 \times 2.772$$

$$= 8{,}174 \text{ (yen)} \qquad (24)$$

So even if 2 items out of 15 exceeded the bounds of acceptability, inspecting all the items would be disadvantageous. When general repairs are made and the item still fails to measure up to required standards, further discrepancies will arise. This clearly indicates that the appropriate diagnostic tuning or prognostication and control methods should be selected to obtain satisfactory quality control.

V. Quality Control in the Business Sector

Even when work is proceeding normally and at a satisfactory pace, if there are defective items and there is no good way to select cheap but reliable methods, the defective items will be shipped to consumers, and this will lead to trouble in the after market or claims. Under such circumstances, to satisfy the claims, appropriate after services will have to be provided. In other words, apologies will have to be made to consumers, defective items replaced by new ones and claims of losses satisfied in order to prevent consumer loss of faith in the item, leading to the potential loss of much bigger orders in the future. Measures to handle claims must be adopted to insure against possible greater losses than the counterclaim costs. Countermeasures that cannot cope with production standards due to lack of technological capabilities or because of economics, finally are settled by claims. When the cost of allowing for claim

coverage is greater than the loss accruing from loss of faith, it is just common sense that countermeasures will not be instituted. Such claims must be met individually and settled in accordance with the best estimates that can be made in the interest of the conduct of business.

VI. Conclusion

There is nothing unique about quality control as it pertains to the automotive industry. The methods described above are applicable almost in toto to all industrial makers. We used the automobile industry insofar as possible to describe the procedures, but it should be clear that regarding automation in industry, measuring system control will move more and more to center stage. In this regard, please refer to chapters 7 and 8 of referenced paper (2).

REFERENCED PAPERS

1. Offline Quality Control: Japanese Standards Association (Nihon Kikaku Kyokai), 1982, by Taguchi.

2. Online Quality Control: Japanese Standards Association (Nihon Kikaku Kyokai), 1979, by Taguchi.

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